RAILROAD GAZETTE

FRIDAY, NOVEMBER 6, 1903.

CONTENTS

Contributions

Purifying Water for Locomotives.

Chicago, Oct. 30, 1903.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In your issue of Oct. 23, p. 755, is an article on purification of water for locomotives in which there are some errors. Injustice is also done some systems because the quality of water treated is not given. For instance, this company treated water at Thompson, Utah, having a much greater quantity of sulphate of lime than the water at Helper and Ruby, Utah, which contains principally carbonate of lime, which is easily handled. The four Tweeddale systems on the Chicago, St. Paul, Minneapolis & Omaha erected by the Helwig Manufacturing Company, St. Paul, Minn., handle very bad water, having 41 grains of sulphate of lime, for 3 cents per 1,000 gallons. So far as cost to purify water is concerned, there is little difference between the different systems and will vary according to the quality of the water.

C. S. BURT, *President.*
Tweeddale Water Softening Company.

[The article referred to by Mr. Burt is an abstract of a report presented to the Association of Railway Superintendents of Bridges and Buildings. It is quite true that the cost of purifying water varies greatly with the character of the water, and comparisons of the relative cost of operation of different systems should be made under similar conditions.—EDITOR.]

Performance of Coal Towers.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In your issue of October 9 I noticed an account of the performance of a Hunt tower, with direct-connected engines and a two-ton bucket. The account says this tower hoisted run-of-mine bituminous coal at the rate of 320 tons per hour to a height of about 90 ft.

Now that bragging is in order, I would like to boast a little concerning the performance of some towers I know of. I have in mind a group of two towers of the Proctor A-frame type, equipped with Rawson & Morrison geared engines having cylinders 10 in. x 12 in. and a boiler pressure of 100 lbs., the boilers being on the wharf about 25 ft. below the engines. The Rawson one-ton bucket is used. I have known these two towers to discharge a steamer of 1,506 tons of screenings, 85 ft. lift, in six hours, reckoned from the time of taking the first bucket until the last scoopful was taken from the deck. This time, of course, included the time occupied in trimming and banking the steamer, which latter could be done more quickly than hauling the towers.

This cargo was loaded on to 65 cars of 44,000 to 60,000 lbs. capacity by a Mead cable road. The fact of the cargo being screenings, and the number of cars loaded, show that the buckets, while filling every time, did not take a ton, which required more trips per 1,000 tons, than would be necessary in digging run-of-mine bituminous or anthracite coals. This is considered a remarkable performance for geared engines—an average of 11 cars, or 250 tons per hour. These two towers have taken 83 cars (about 2,000 tons) run-of-mine bituminous out of a 3,000-ton barge in 9½ hours, taking out the whole cargo inside of 14 hours, actual working time.

I also know of a Rawson & Morrison direct-connected rig taking out 900 tons of anthracite coal in four hours from a barge. This tower has a 14 in. x 24 in. engine, with steam at 100 lbs., 24 in. drums, and a 75 ft. lift, using a one-ton Rawson bucket. The above is not the maximum capacity of the geared engines, as they did not run steadily, owing to the fact that the cable road, running eight 2½-ton cars on a 1,000-ft. loop, could not keep the tower hoppers clear of coal.

If any of your readers know of any similar rigs that can equal these performances, I should be pleased to know of them.

J. V. N. CHENEY.

The Miller Mechanical Refrigerator Car.

New York, Nov. 2, 1903.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Referring to your article in the *Railroad Gazette* Oct. 23, on the Miller mechanical refrigerator car, the following figures on the power taken from the axle may be of interest: With the atmospheric temperature at 86 deg. and ordinary summer humidity we realize condenser pressures of about 70 atmospheres which gives a total mean effective pressure on the piston of the ice machine of 700 lbs. Measured at the rim of the car wheel, 40 lbs. pull on the rim or on the drawbar will overcome this pressure on the piston and operate the machine. This pull does not vary with the speed of the train, but with the temperature of the air through which the car is passing, which temperature determines the pressure in the condenser against which the ice machine must pump. In cooler weather the drawbar pull of 40 lbs. drops sometimes as low as 25 lbs. on a sharp clear day with the thermometer at 65 deg.

The fastest speed realized by a freight locomotive hauling a train of 30 cars loaded with perishables, may be taken at 50 m.p.h. At this speed the train resistance is usually estimated at 12 lbs. per ton. Now as each mechanical car has an additional drawbar pull of 40 lbs., the total extra pull per train is 1,200 lbs. This is equivalent at 12 lbs. per ton to 100 tons less capacity due to the ice machines. The machines weigh 1,800 lbs. each, which gives an additional dead load of 27 tons, making a total of 127 tons loss. However, the initial icing per car at present is six tons, or 180 tons per train. The mechanical cars require but one ton each for a reserve, so that subtracting this and the 127 tons due the equipment, leaves a balance of 23 tons in their favor over the present trains, thus refuting the argument that the power taken from the locomotive destroys their usefulness. In addition to this the freight space in these cars is 32 ft. long, against 27 ft. in the usual 35 ft. end-ice-box car, giving them 5 ft. more room in their favor. This space is 5 ft. x 7 ft. x 8 ft. = 280 cu. ft. gained. The other cars have 1,510 ft. available, which gives two-elevenths more capacity in the mechanical car. As the cargoes average 26,000 lbs. per car, this space will take 4,726 lbs., or two-elevenths of the average. This for a train of 30 cars is 141,780 lbs. of additional paying freight per train of the same number of cars as formerly hauled, thus giving a largely increased revenue per locomotive besides reducing the ice expense, five-sixths of its former amount.

WARREN H. MILLER.

Alloys for Bearing Purposes.*

Much uncertainty exists as to what is the best constituted alloy for journal brasses for railroad service. Hundreds of formulas have been recommended, and 99 out of each 100 founded upon the grand principle of "guess." At first glance it may appear an almost hopeless task to even surmise which alloy is best constituted for such service; but upon closer examination we find that but few metals are available. They are copper, tin, lead, zinc and antimony.

It is true that other metals and metalloids may be introduced in varying small proportions, either with or without some material advantages, but the above five metals constitute the basis which may be used for the so-called anti-friction alloys. The combinations of the above metals, which to-day figure in service for this purpose, may be classed under two heads: white metals and bronzes.

The essential points to be considered in connection with alloys for railroad journal bearings are: (1) Composition; (2) structure; (3) friction; (4) temperature of running; (5) wear on bearing; (6) wear on journal; (7) compressive strength; (8) cost.

It is an utter impossibility to have one alloy reach the pinnacle of perfection in all the above requirements; for example, the metal showing the slowest rate of wear may have the highest coefficient of friction, or the metal with the lowest coefficient of friction may have the greatest rate of wear, etc. If it were possible to reach mechanical perfection in the adjustment of bearings it would be of little consequence what alloy or metal were used, providing the same had sufficient strength to support the load without deformation. If perfect adjustment were possible we would have at no time metal in contact with metal, but simply metal in contact with oil; the friction would be essentially fluid friction and abrasion due only to the wear of fluid against solid. But, unhappily, such a state of perfection can scarcely be reached, and never will be reached in railroad journal bearings, where end thrusts, lateral motion, reversal of direction of motion, etc., are continually encountered. Such being the existing state of affairs, the above tabulated qualifications must be studied and each balanced against the other according to its importance.

1. First and foremost is the qualification that the alloy have the best composition, all things considered, to make the bearings. On this depends all the following essentials.

2. On the composition in a great measure depends the structure. It has been shown that a successful bearing alloy must consist of at least two structural constituents —one hard constituent to support the load, and one soft constituent to act as a plastic support for the harder grains. Generally speaking, the harder the surfaces in contact, the lower the coefficient of friction, and the higher the pressure under which "gripment" takes place.

It would seem for this reason, the harder our bearing alloy, the better. It was with this idea in mind that alloys of copper and tin were so extensively used in the early days of railroading. A hard unyielding alloy for successful operation must, however, be in perfect adjustment, a state of affairs unattainable in the operation of rolling-stock. In order to obtain a proper adjustment of bearings when first applied in service, Mr. Hopkins many years ago introduced his lead-lined bearing. The practice of lining bearings has now become almost universal in this country. But notwithstanding that the bearing by this method obtains a good seat on the journal, the adjustment is constantly disturbed, and the bearing proper must have a certain plasticity of its own to avoid heating when called into service to support the load. In order to secure this plasticity, lead was introduced into the copper and tin alloy, with excellent results.

3. The next consideration is friction. Friction is dependent upon the composition and structure of the alloy. Generally speaking, the harder the metals in contact, the lower the coefficient of friction; thus the class of bronzes have a lower coefficient of friction than the babbitt or white metals. At the same time, the harder the metal, the greater the liability of heating, because of the absence of plasticity. A hard unyielding metal under the above conditions will cause a concentration of load upon one or more high spots, and so cause an abnormal pressure per square inch on such areas, with the result that rapid abrasion and heating soon result. A hard unyielding bearing is a theoretical delusion, much to be desired, but impracticable of application.

Structure of the alloy plays an important part, as hard spots caused by oxidation, etc., frequently cause an irritation of the journal with a simultaneous production of abnormal friction and temperature.

4. Temperature of running is of importance to the extent that the amount of oil consumed is greater, the higher the temperature, but at the same time the lower the friction, providing the bearing is running under normal conditions. This is true only when comparing the same bearings under different temperatures, because the higher temperature may be caused by increased friction. Generally speaking, the bronzes under the same conditions of pressure and speed will operate at a lower temperature than the softer metals, all things being equal.

5. The relation existing between composition and wear is quite remarkable. High-priced compositions are being used, which have but little resistance to wear compared with cheaper compositions, and low-priced alloys are in service that are not cheap at any price.

6. Composition of the bearing has a decided effect upon the wear of the journal; but whether the difference in the rate of wear is due directly to the composition is a disputed point, no positive proof to this effect being attainable. It is generally conceded that the soft-metal bearings cause a marked decrease in the life of journals. Whether this is due to the imbedding of grit on the bearing surface, with the consequent formation of a lap, or to the fact that the metal itself has a dragging nature, I am not prepared to say. In a recent paper Mr. David Van Alstine gives some statistics on the life of journals.

(1) Tender axles, for ½-in. wear—490,000 miles; 5 per cent. removed for collar wear.
(2) Engine truck axles, for ½-in. wear—245,000 miles.
(3) Driving axles, for ½-in. wear—476,800 miles.
(4) Freight car axles—274,000 miles; 29 per cent. removed on account worn collars.
(5) Passenger car axles—504,000 miles; 94 per cent. removed on account collar wear.

Mr. Van Alstine attributes the low mileage shown by English truck axles to the fact that the brasses are babbitted. Driving axles, he declares, have a tendency to wear tapering and hollow. This he attributes to the uneven distribution of dirt in the packing.

Uneven wear is caused in many cases, however, by the use of babbitt strips across the bearing surface; at any rate, the tendency to wear hollow can be traced to this cause. In one instance the strips were set according to the usual practice but only over a part of the length. A depressed area plainly marked the increased rate of wear due to the babbitt strips. To remedy this defect the babbitt strips were allowed to extend the entire length: the result was an even but proportionately greater rate of wear. The above conditions and the fact that babbitt often becomes so heated as to melt and run out, causing frequently serious trouble, is a good argument for the abandonment of such practice.

The low mileage of freight-car as compared with passenger-car axles is attributed to the fact that they receive less attention, which is quite plausible, ill-fitting lids

*Extracts from a paper presented to the Franklin Institute by G. H. Clamer, Vice-President of the Ajax Metal Co.

and dust-guards allowing more dirt to enter the box and cause abrasion. It is surprising to learn that 94 per cent. of the passenger-car axles are removed on account of worn collars. This state of affairs may, without much hesitation, be laid to the lead lining of brasses lapping out the fillets. That such is the case is an undisputed fact. Fillets are not only worn to a right-angle, but are often cut in to an acute angle.

A test of the compressive strength of alloys intended for use as bearings is of importance in indicating: (1) If the alloy is hard enough to support the load without deformation. (2) If the alloy is brittle and will split under effects of pressure. (3) If it is sufficiently plastic to reasonably suppose it will run cool under aggravated conditions.

Having briefly discussed the qualification of the bearing metal, let us take up the various combinations of metals as previously classified and study their characteristics.

1. *Lead and Antimony.*—These metals will alloy in any proportion. With increase of antimony the alloy becomes harder and more brittle. The combination of these two metals, however, which alone is exempt from segregation, is that of the eutectic mixture, which according to various authorities has been found to be approximately: lead 87 per cent. and antimony 13 per cent. The melting-points, as given by Stead, are for the segregated antimony about 615 deg. C., and for the eutectic 247 deg. C. The temperature of the eutectic is 78 deg. below the conceded melting-point of lead—the most fusible constituent; therefore in an alloy below 13 per cent. antimony, the lead crystallizes out of the still fusible eutectic in the form of "fir tree" lead.

According to Charpy, an anti-frictional alloy should consist of hard grains, which carry the load, imbedded in a matrix of plastic material, to give it the property of molding itself to the journal and its irregularities without undue heating. Such a condition is met in the alloys above the eutectic composition; but with increasing antimony the alloys become more brittle, and above 25 per cent. are unsafe in service for this reason. The Pennsylvania Railroad, at the suggestion of Dr. Dudley, has adopted the 13-per-cent. antimonial-lead alloy as a filling metal for bearings in order to obtain the best results. Lead is the best wear-resisting metal known, and with increasing antimony, or increasing hardness and brittleness, the wear becomes more marked. This is due to the splitting up of the harder particles.

The friction becomes less with increase of antimony, and the temperature of running likewise diminished when running under normal conditions; but the harder the alloy, the more difficulty is experienced in bringing it primarily to a perfect bearing, and the greater the liability of heating through aggravated conditions. The wear on the journal one would naturally expect to be decreased with increasing hardness; but this journal wear is in all probability not due so much to the alloy directly as it is to the fact that the softer metals collect grit, principally from the small particles of steel from the worn journal, and, acting as a lap, causing rapid wear. With the harder metals these particles are worked out without becoming imbedded. The cost of this alloy is the least which can be produced. It can be used in many services where higher-priced alloys are being relied upon mainly for their high cost.

2. *Lead, Antimony and Tin.*—I do not wish it understood that antimony-lead is the cheapest alloy to use under all circumstances; when high pressures are to be encountered, tin is a desirable adjunct. Tin imparts to the lead-antimony alloy rigidity and hardness without increasing brittleness, and can produce alloys of sufficient compressive strength for nearly all uses. The introduction of tin into the finely crystalline antimonial lead of commerce gives it a coarser grain, due to the formation, no doubt, of the cubical crystals of the chemical combination of SbSn. The cost of the alloy increases with increase of tin; but for certain uses, where insufficient compressive strength cannot be gotten by antimony, because of its accompanying brittleness, it is indispensable, and will answer in nearly every case where the tin basis babbitts are used.

3. *Tin, Antimony and Copper.*—This combination is genuine babbitt. The formula is: tin, 88.89; antimony, 7.41; copper, 3.70.

This formula has been adopted by many of the leading railroads, the United States Government and many industrial establishments. It is used in the majority of cases where cheaper composition would do equally as well.

4. *Tin-Antimony-Lead-Copper.*—Lead, although of itself a soft metal, renders this alloy, when added in but small proportions, harder, stiffer, more easily melted and superior in every way to the alloy without it, and yet consumers will raise their hands in horror when a trifling percentage of lead is found in their genuine babbitt. This is one of the instances where cheapening of the product is beneficial.

The foregoing are of far more importance in the arts than the white metals, the main portion or basis of which is zinc. At various times new combinations of zinc have been proposed, but they have not come into popular use for two reasons. First, because of the great tendency of zinc to adhere to iron when even slightly heated. What is technically known as galvanizing the journal is effected under these conditions. Second, because of the brittleness produced under the effects of heat, such as is produced by friction when lubrication is interfered with and consequent danger of breakage.

Bronzes.—Bronze is the term which originally was applied to alloys of copper and tin as distinguished from alloys of copper and zinc; but gradually the term "bronze" has become applied to nearly all copper alloys containing not only tin, but lead, zinc, etc., and no sharp lines of demarcation exist between the two.

The tests described below were conducted on a testing machine designed by Professor Carpenter, of Cornell University, and built by Olsen, of Philadelphia. The data obtained were: (1) Loss of metal by wear obtained by weighing before and after test. (2) Friction in pounds. (3) Temperature of running.

The most satisfactory method of lubrication thus far found has been that of ordinary car lubrication, viz.: by means of waste held to the under side of the journal. Each of the alloys tested was subjected to chemical analysis and microscopic examination to obtain as complete a knowledge as possible of the alloys under consideration.

The first series studied is that of copper and tin.

Copper 85 per cent., Tin 15 per cent.—Microscopic examination shows this alloy to be made up of chemically combined copper, $SnCu_3$, dendrites of pure copper, and a large area of eutectic mixture, 73 per cent. copper and 27 per cent. tin.

The tests on the machine show:

Friction in pounds	13
Temperature above room, deg. F	50
Wear, in grams	.2800

The friction is lower than that of any of the following alloys which were tested, they being all softer than the above. The temperature of running, being a factor of the friction, is likewise less. The wear, however, is greatest of all, no doubt due to the large amount of hard brittle eutectic present (copper 73, tin 27).

Copper 90 per cent., Tin 10 per cent.—This alloy has the same general structure as the alloy of 15 per cent. tin, but differs in the greater amount of free copper and lesser amount of eutectic which it contains.

Machine tests:

Friction in pounds	13
Temperature above room, deg. F	51
Wear, in grams	.1768

The friction was practically the same, and temperature a little higher than the foregoing, but the rate of wear slower, owing to the smaller amount of eutectic and its consequent softness.

Copper 95 per cent., Tin 5 per cent.—This alloy contains, beside the $SnCu_3$, large amounts of free copper, and but small amount of eutectic, especially if the alloy is quickly cooled.

Machine tests:

Friction in pounds	14
Temperature above room, deg. F	52
Wear, in grams	.0776

Friction and temperature are here again higher, and the rate of wear greatly diminished.

Dr. Dudley, in a paper which he read before the Franklin Institute in 1892, showed the relation existing between the tin and lead content of the copper alloy, and his determinations were founded on actual practical tests. Their relation to the tin content are summed up in his own words, as follows: "The rate of wear diminishes with the diminution of tin."

The copper, tin and lead alloy is now recognized the standard bearing-bronze, and in the above-mentioned paper the fact was clearly established that lead introduced into the copper-tin alloy was a decided advantage; first, because the bearing containing lead was less liable to heat, under the same state of lubrication, etc.; and, second, the rate of wear was greatly diminished.

Three points should be noted: (1) The rate of wear diminishes with the decrease of tin, as above stated. (2) The rate of wear decreases with the increase of lead. (3) Arsenic and phosphorus apparently have no bearing on the wearing qualities.

Copper 90 per cent., Tin 5 per cent., Lead 5 per cent.—Microscopically, this alloy shows the presence of pure copper, practically pure lead in mechanical admixture, and the copper-tin eutectic (consisting of copper and crystals of $SnCu_3$).

Machine test:

Friction in pounds	16
Temperature above room, deg. F	53
Wear, in grams	.0542

Copper 85 per cent., Tin 5 per cent., Lead 10 per cent.—This alloy shows the same general characteristics as the foregoing, but a larger field occupied by the lead. The lead is clearly seen without etching, and is shown to be held in little pockets, or a network, of copper and tin.

Machine test:

Friction in pounds	18½
Temperature above room, deg. F	56
Wear, in grams	.0308

Copper 80 per cent., Tin 5 per cent., Lead 15 per cent.—Microscopically the same as above.

Machine test:

Friction in pounds	18½
Temperature above room, deg. F	58
Wear, in grams	.0327

In view of the foregoing knowledge it seemed to be highly desirable to produce an alloy with as much lead and as little tin as possible, not only for the reason that such an alloy is less liable to heat in service, and at the same time show a diminished rate of wear, but also because the two expensive metals, viz.: copper and tin, are replaced by a far cheaper metal—lead.

The paper here explains in detail the experimentation by which the desired alloy was obtained. But it was found that in large bulk it cooled so slowly that the lead, which solidifies at a point more than 300 deg. below the eutectic, owing to its high specific gravity liquated to the bottom of the casting, seriously impairing the uniformity of the alloy. It was necessary to add an element that would cause rapid setting of the cast metal, and nickel was found to answer the purpose, in proportions of from ½ to 1 per cent. The resulting alloy is known as "Plastic Bronze."

Having accomplished the production of an alloy containing upwards of 20 per cent. lead, the next object was to test it in the manner of the previous ones, the tin being kept constant at 5 per cent.

Copper 75 per cent., Tin 5 per cent., Lead 20 per cent.—No nickel was used in the test bearings, as it was thought desirable to have no other elements present. Microscopically the alloy showed a structure having a network of copper and tin, and large area of mechanically-held lead.

Machine test:

Friction in pounds	18½
Temperature above room, deg. F	58
Wear, in grams	.0277

Copper 70 per cent., Tin 5 per cent., Lead 25 per cent.—Same as above.

Machine test:

Friction in pounds	18
Temperature above room, deg. F	58
Wear, in grams	.0204

The friction here is little less than above.

Copper 65 per cent., Tin 5 per cent., Lead 30 per cent.—Microscopically examined, large portion of the field is shown to be covered by lead.

Machine test:

Friction in pounds	18
Temperature above room, deg. F	64
Wear, in grams	.0130

The conditions in all above-described tests were as follows:

Total number of revolutions made	100,000
Revolutions per minute	525
Size of journal	3¾ in. diameter, 3½ in. long
Pressure per sq. in. in pounds	1,000

The alloy which we have adopted consistent with proper strength for general purposes and with the best foundry results is copper 64 per cent., tin 5 per cent., lead 30 per cent., and nickel 1 per cent.

What is true of the alloys of 15 per cent. lead and under, as examined by Dr. Dudley, is also true of the high-lead-content alloys, viz.: that the rate of wear diminishes with increase of lead, or, in other words, the rate of wear diminishes with the diminishing compressive strength or increased plasticity of the alloy. This alloy has plasticity resembling babbitt metals, and for this reason can fairly be expected to show a less tendency to become heated.

There remain several other classes of bronzes, which, owing to their low cost of production, are largely used. They are alloys of copper and tin containing zinc, or containing both zinc and lead. Such alloys as these can be made from miscellaneous junk, and hence the low cost of production. Foundry and machine tests have been made of a number of these, which brought out the following conclusions:

(1) Zinc increases the rate of wear.

(2) Zinc has a tendency to segregate lead.

These miscellaneous alloys, containing copper, tin, lead, zinc, iron and other metals, form a very large part of the present railroad equipment in bearings, it having long been the practice to use junk of every conceivable variety in their manufacture. Materials which could not be used for any other purpose were considered good enough for car brasses; but railroad officials are gradually becoming educated to the fact that the best is none too good.

The Farlow Draft Gear.

Mr. John H. Farlow, General Manager of the South Baltimore Steel Car & Foundry Company, has patented a new type of draft gear and attachment which is a departure from the usual form of yoke or pocket attachment gears. It consists essentially of the springs, two followers of special design, two yoke bars, two cheek plates and three heavy equalizing pins or keys. One key passes through the slot in the shank of the coupler originally intended for the American continuous draft gear key, and is free to move in an elongated slot through the sills and cheek plates on each side. The middle key passes through the front follower and the sills, but has no movement, serving only as a front follower stop. The rear key engages the rear follower, and slides in an elongated slot in the sills.

The same principle is used in all of the designs shown in the accompanying engravings. Besides the three types shown, two other forms of tandem gear and a twin-spring gear have been designed, differing only in detail from those shown. The class A gear shown in Fig. 1 is a single-spring gear for cars with wooden draft sills. The two cast-steel cheek plates are gained into the sills flush with the surface, and are bolted up with two bolts at each end. The front and back slots in the cheek casting are elongated to allow the equalizing keys to move the full distance allowed for travel of the coupler. In pulling, motion is imparted to the front and rear keys, the yoke bars and the rear follower block, simultaneously. The middle key is fixed and holds the front follower, so that as the rear follower moves forward the spring is compressed. When the spring becomes solid, the front and rear keys

have come to a bearing at the ends of the elongated slots in the sills and at the same time the yoke bars bear on the middle key, having moved forward the length of the slot in the bars at that point. Further stress is thus taken up by the sills through the three keys. In buffing, the rear key carrying the rear follower comes against the back of its slot in the sills, and when the front follower is moved back by the drawbar the spring is compressed. The front follower having an elongated slot, moves over the middle key, which remains stationary. The forward key moves with the drawbar in the elongated slots in the sills and carries the yoke bars with it. These move over the rear key, and when the spring is closed, the blow is again taken on all three keys.

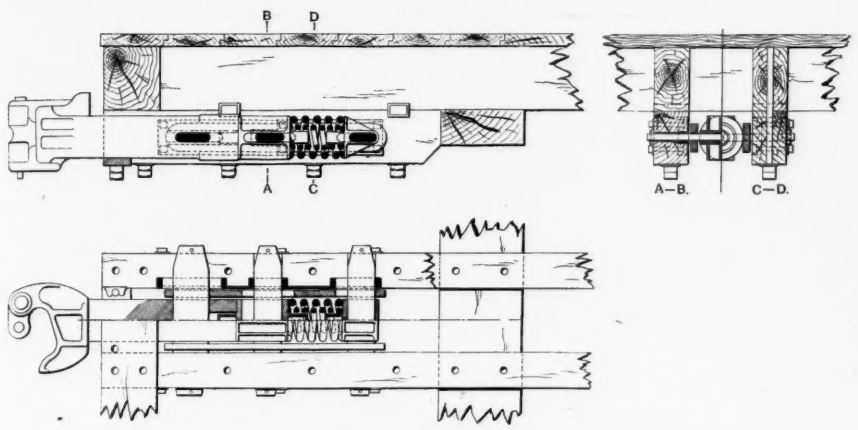


Fig. 1.—Farlow Single Spring Draft Gear, Class A.

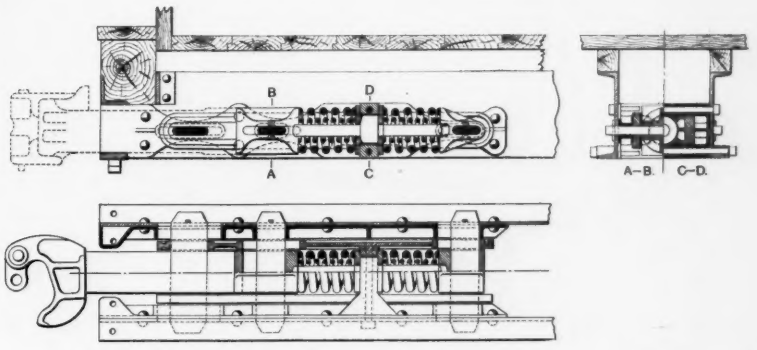


Fig. 2.—Farlow Tandem Spring Draft Gear, Class D.

Fig. 2 is the class D, tandem-spring gear, applied to steel channel sills. Two middle follower plates and a spring spindle are required in addition to the parts in the class A gear. The yoke bars have lugs cast on them to engage the middle followers. In pulling, the yoke bars move forward with the front key and carry with them the rear key and follower, compressing the rear spring. At the same time the lugs on the yoke bars engage the middle follower plate and compress the forward spring. The spring spindle bears on the front follower, which is solid against the middle key, and the shoulder in the center of the spindle forms a seat for the middle follower plate, against which the rear spring bears. In buffing, the drawbar compresses the front spring, and the lugs on the yoke bars engaging the middle follower, compress the rear spring. The spring spindle bears on the rear follower, and the shoulder on it forms a seat for the front spring follower.

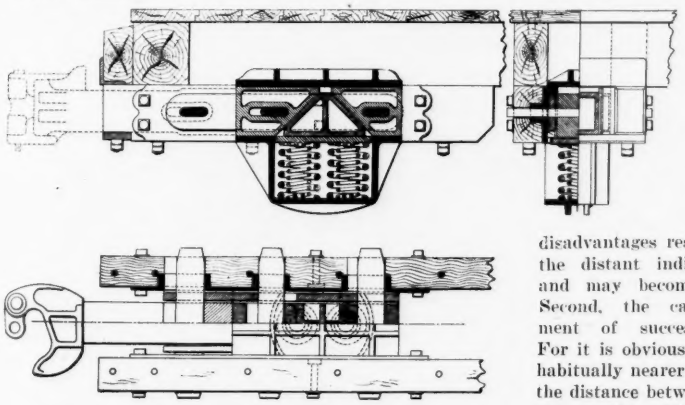


Fig. 3.—Farlow Friction Draft Gear, Class F.

The friction gear, class F, shown in Fig. 3, has the same method of attachment as the spring gears. The draft sills, carry iron, and underhung spring pocket, are one casting of steel. Two standard M. C. B. draft springs are used which are compressed vertically in both pulling and buffing. The front wedge is carried loosely on the middle key, and the rear wedge is fixed on the rear key. In pulling, the front wedge is fixed and the rear wedge moves forward with the yoke bars and rear key, forcing the middle wedge down against the pressure of the springs. In buffing, the front wedge moves with the drawbar, and forces the middle wedge down, the rear wedge block being solid on the key which bears against the end of the slot in the sills. There are four frictional surfaces moving over each other in both pulling and buffing; the top surface of the front or back wedge, as the case may be, moving over the under surface of the top tie plate; the inclined surface of the front or back wedge moving over one face of the middle wedge; the inclined face of the other wedge moving over the opposite face of the middle wedge; and the bottom face of the middle wedge moving over the top surface of the spring cap. In this gear, as in the other two, when the limit of the movement of the gear and consequently its capacity has been reached, the remainder of the blow is taken to the sills equally at the three points of contact of the keys.

To replace any part in any of the gears, it is only necessary to drive out one or more of the keys, and when the gear is to be reassembled, the keys are driven back into place. The taper on the ends of the keys takes up the compression as they are driven into position. All of the parts are simple in design, and of ample strength.

Three-Position Signals vs. Separate Home and Distant.*

The principal matter on which this committee has to report is evidently the relative merits of the three-position and the separate distant signal as a means of giving the distant indication in connection with automatic block signals.

The overlap system is a sacrifice of principle for economy, or it presupposes that the signals will not be rigidly observed. It involves the vicious inconsistency of requiring the engineman to stop at each signal that is found in the stop position, while it is freely recognized that, under certain conditions that will arise in the proper running of a train, the stop will be impossible. The overlap indeed insures that if a stop is made as quickly as possible when a signal is overrun, no harm will result. But such incomplete signaling can hardly fail to diminish the respect of many enginemen for other stop signals and must be a severe trial to the conscientious man who wishes to obey the rules and also make time in thick weather. Whatever service the overlap system has rendered in the early development of automatic signaling, the committee feels that a point has now been reached where the saving of cost cannot justify the sacrifice of principle. Inconsistency and lack of uniformity in signaling tend to bring about disregard of signals; the constant raising of the standard of safety at the present day demands expenditure to remove such inconsistencies. The committee therefore recommends that the future installation of overlapping automatic block signals be condemned as contrary to good practice.

Whether the distant indication for one home signal should be given on the same post with the next home signal in the rear or on a separate post within the block depends, in the opinion of the committee, on the length of block. It will be assumed that the ideal distance between a distant signal and its home is practically that in which any train that is likely to run on that piece of road can be stopped. If the distance is very much greater than this, three disadvantages result. First, the engineman has to carry the distant indication in mind an unduly long time and may become confused in his recollection of it. Second, the capacity of the road for the movement of successive trains at speed is decreased. For it is obvious that trains cannot, with safety, be run habitually nearer together than the length of a block plus the distance between a home signal and its distant. Since the capacity of the road decreases as the length of block increases, there is a double loss if the distant is kept on the same post with the home when the length of block much exceeds the necessary distance for the distant signal. Third, slight delays, especially in thick weather, will become more numerous; for the farther a distant signal is from its home, the oftener it will happen that a train will reach the distant before the home is clear. In the opinion of the committee, these disadvantages outweigh the obvious advantages of concentrating the home and distant indications on one post, and it is recommended that, where the usual length of block must be much greater than one mile, the distant indication be given on a separate post.

When distant signals were first used in connection with automatic blocks of moderate length, nothing was more natural than that a separate signal should be placed on the same post with and below the home; this was simply following the practice that had already been established both in England and America in connection with mechanically operated signals. The use of a single three-indication signal to do what had been done by the two signals, was a later conception. This was first tried on the Pennsylvania Lines West of Pittsburg in the summer of 1899 and was in regular service the following year. Since that time it has been extensively installed on those lines and is standard. These signals are also used on the Pere Marquette.

The arguments offered in favor of the three-position signal against the separate home and distant are:

1. There being but one signal arm or one light to watch, the indications are simpler and more easily understood by the engineman.

2. The indication is the same as that given by the station or telegraph block signals; the three-position signal conforms with the interlocked signals more nearly than the separate home and distant, and in every way conforms to correct principles.

3. The cost of installation is less; the three-position (electric semaphore) signal costs $210, while the two-arm signal costs $300.

4. The three-position signal of the improved type, having nearly one-half fewer parts, is less complicated than the two-arm signal.

5. The cost of maintenance is less; there is but one lamp to keep up and, as there is but one pair of lock or clutch magnets, the current consumption is reduced almost one-half.

It is stated that, in a certain territory, a number of train crews have part of their run on a road equipped with three-position automatic signals and part on tracks having automatic signals with home and distant on the same post; several of the enginemen were questioned as to their preference and all answered that they liked the three-position signals better.

On the side of the separate home and distant arrangement it is claimed:

1. The vertical clear position of the blade of the three-position signal is objectionable because it is not sufficiently conspicuous and distinctive; the blade would take this position in case of a breakage of the semaphore casting between the bearing and the up-and-down rod; and, it is believed, if the blade is broken off, its absence might be overlooked and be taken for a clear signal.

2. In comparison with the separate home and distant on the same post, the three-position signal has only one light, and when one light is out all are out; there is then no marker showing the location of the signal, and it may easily be overrun. This is not true of the other system, as the chance that two lights on the same post will be out at the same time is very remote. Where two lights are used, always in the same relative position, the indication becomes more distinctive and less likely to be confused with other lights.

3. Again comparing the three-position signal with the home and distant on the same post: Indications for two blocks are given at each semaphore. The mental process of reading two separate indications is simpler than getting the information from one light or one blade—the upper blade, or upper light, refers to the first block and to nothing else, and the lower blade, or light, to the second block and nothing else. The distant signal blade (by day) exactly repeats the positions of its home, while a certain position of the three-position signal represents an entirely different position of the signal in advance.

4. Consistency and uniformity are sacrificed, not enhanced, by using the same signal for automatic block work as for telegraph block and making the caution and clear positions of the signal serve as distant indications for the next signal ahead. At a telegraph block station the caution indication of the signal means, "There *is* a train in the block ahead; proceed with caution;" as an automatic block signal it means, "There is *no* train in the block ahead, but the next signal is at danger." The clear indication of the telegraph block signal means merely that the block ahead is clear but gives no clue to the indication of the next signal; as an automatic signal, it means that the block ahead is clear and also that the next signal is not in the stop position. These are radical differences between the significations of the same signals when found at different places along the same road.

The committee thanks a large number of members who sent replies to its circulars, several of which were very complete discussions of the subject. Ninety-five per cent. of these replies favor separate home and distant signals, and, of course, the greater part of the automatic block signals now in service are of that type. The question is, therefore, not merely whether the three-position system is preferable to the other, but whether it is so far superior as to justify an effort to make it a standard for general adoption at the cost of ultimately changing the separate home and distant signals now in use. Good arguments are advanced on both sides, but the unanimous conclusion of the committee is that the two are pretty evenly balanced. The committee, therefore, finds no sufficient reasons for recommending that the common practice of using separate home and distant signals on the same post should be departed from in favor of the three-position signals.

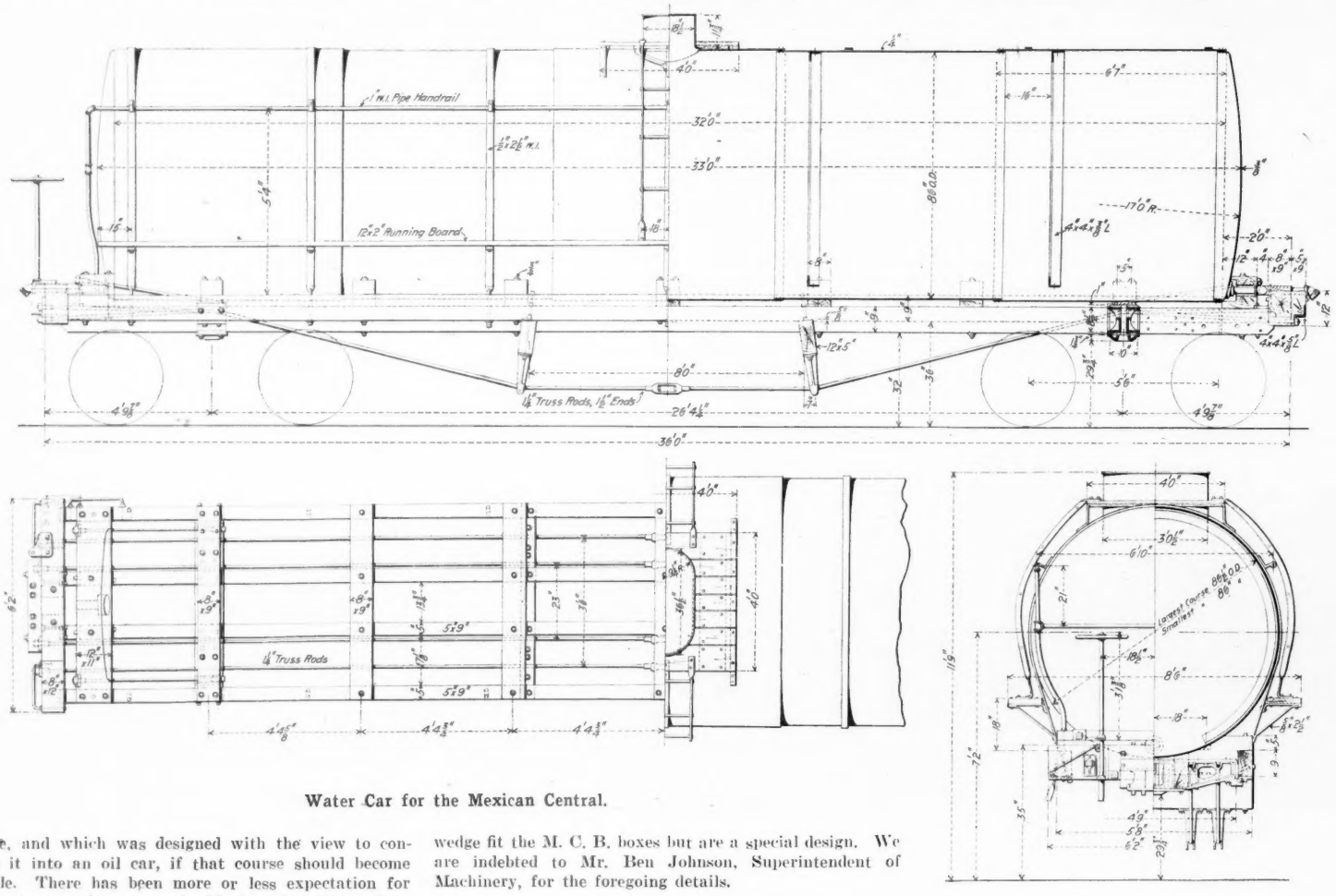
*Report made to the Railway Signaling Club, Detroit, Nov. 10, by a committee consisting of Messrs. C. C. Anthony (chairman), G. B. Gray, W. W. Slater, E. D. Wileman and A. R. Raymer.

Mexican Central Water Cars.

On the Mexican Central, as on some far western roads, there are long stretches where it is impossible to obtain water either by digging wells or by storing rain water, for there are neither rains nor rivers. There are other places where the only water to be had is unfit for use in engines, and it has therefore been necessary to provide water cars. The accompanying illustration shows a 9,800-gal. tank car in use on the Mexican Central for this purpose, and which was designed with the view to converting it into an oil car, if that course should become desirable. There has been more or less expectation for the past two or three years in Mexico of striking oil in sufficient quantities to permit its use as a fuel on the railroads. Up to the present time, however, it has not been obtained. There are 10 of these cars now in service which were built about a year ago by the Western Steel Car & Foundry Co., and they have given entire satisfaction. Ten are now being built by the South Baltimore Steel Car & Mfg. Co., and 10 more will shortly be ordered.

These cars have yellow pine sills, 9 in. x 5 in., with the steel tank resting on white oak saddles. The tank is 7 ft. 2 in. in diameter and 33 ft. over ends, and is made of ¼-in. plate. All seams are double riveted. The body bolsters are 1-in. x 10-in. wrought-iron plates with malleable iron filling blocks between the sills. The body center plates are cast steel. Westinghouse friction draft gear is used on all the cars, the first 10 having it attached directly to the center sills, while on the succeeding ones malleable-iron draft sills will be used, applied as shown by the illustration. This draft gear has proved satisfactory although the service has been severe. The dead-wood angles show scarcely any defacement from blows of the horns of the couplers. Five of these cars have been used as a special water train between two points where the grade is 3 per cent.

These cars have the Mexican Central standard 80,000-lb. truck illustrated in the *Railroad Gazette* Nov. 9, 1900. National-Hollow brake-beams and the Mexican Central 5-in. x 9-in. brass and wedge are used. This brass and wedge fit the M. C. B. boxes but are a special design. We are indebted to Mr. Ben Johnson, Superintendent of Machinery, for the foregoing details.



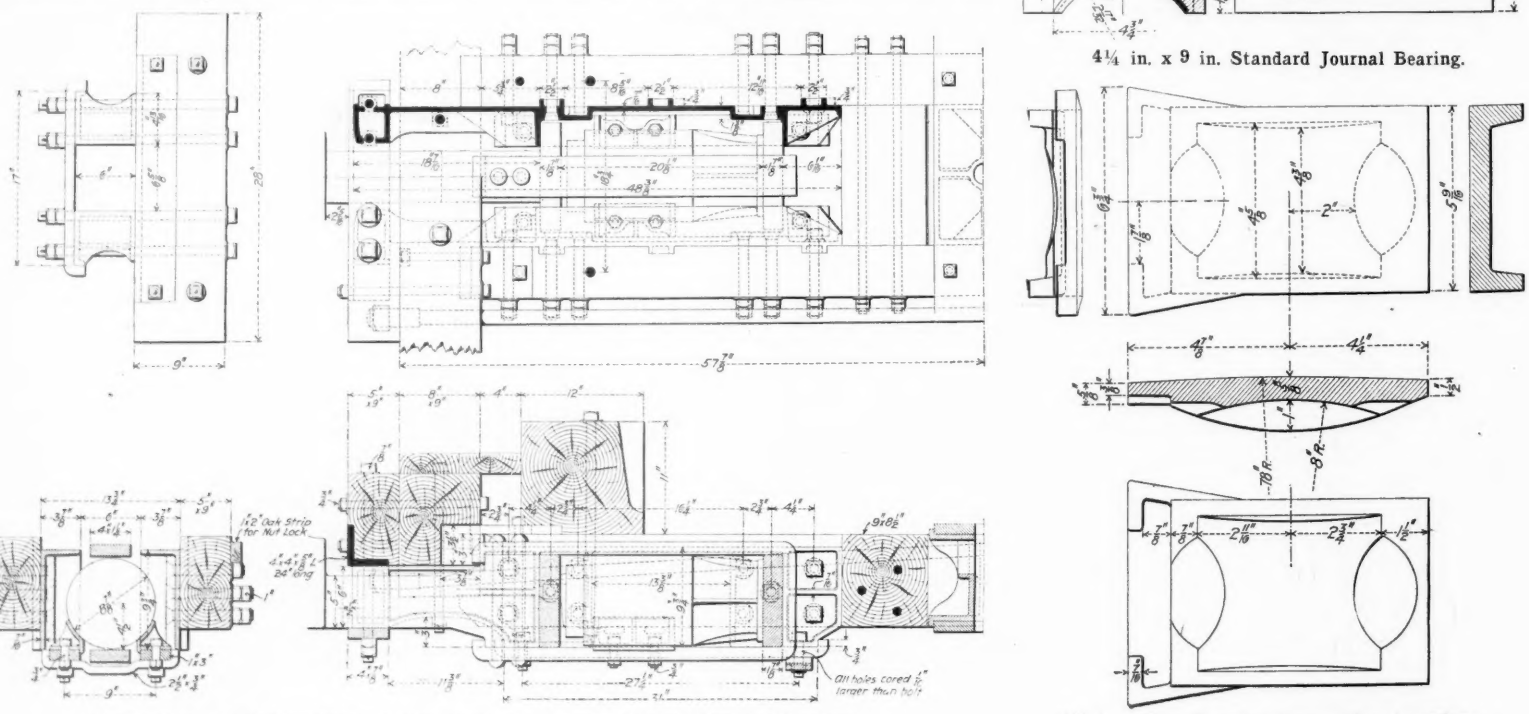
Water Car for the Mexican Central.

Grab-Irons on the Front Ends of Locomotives.

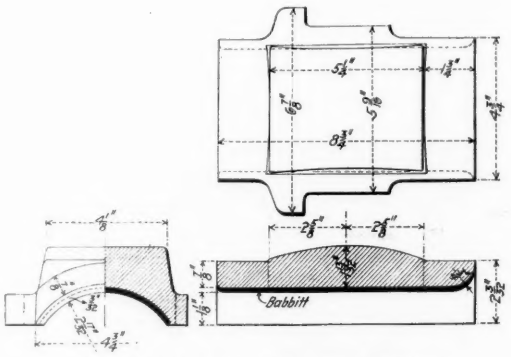
Messrs. C. H. Quereau, W. S. Morris and J. Milliken, the committee of the Master Mechanics' Association on the Location of Grab-Irons on the Front Ends of Locomotives, have made their report. The committee acquainted itself with the requirements of the safety appliance law relating to grab-irons on the fronts of road locomotives, as interpreted by the Interstate Commerce Commission, which were kept in view in preparing the report. Also the report undertakes to answer the questions raised by the Superintendents of Motive Power. The opinion among motive power and operating officers that grab-irons will be dangerous instead of a safeguard was urged on a representative of the Commission, without avail. The report says:

The law does not require the application of steps, either to the pilot or on the tender. The law does not refer to hand-holds on the smoke arch, but to hand-holds or grab-irons on the pilot or front bumper beam. A grab-iron at the front end of the engine, on the side, is not required. The Master Car Builders' standards for grab-irons on freight cars cover the following points, which we would recommend to apply in the case of grab-irons on locomotives:

Grab-irons should be secured by lag screws, rivets or bolts not less than ½ in. in diameter.



Application of Westinghouse Friction Draft Gear to Mexican Central Water Cars.



4¼ in. x 9 in. Standard Journal Bearing.

4¼ in. x 9 in. Standard Journal Bearing Wedge.

The diameter of the iron used for grab-irons should be not less than ⅝ in.

The clearance between the grab-iron and the piece to which it is fastened should be not less than 2½ in.

If the uncoupling rod meets these requirements, and has a diameter sufficient to give the required stiffness, it will answer as a grab-iron.

If the uncoupling rod extends only from one side of the engine to the coupler, we recommend a grab-iron on the opposite end, on the bumper.

If the uncoupling rod extends across the front end of the engine, no other grab-iron is required there. We recommend this construction.

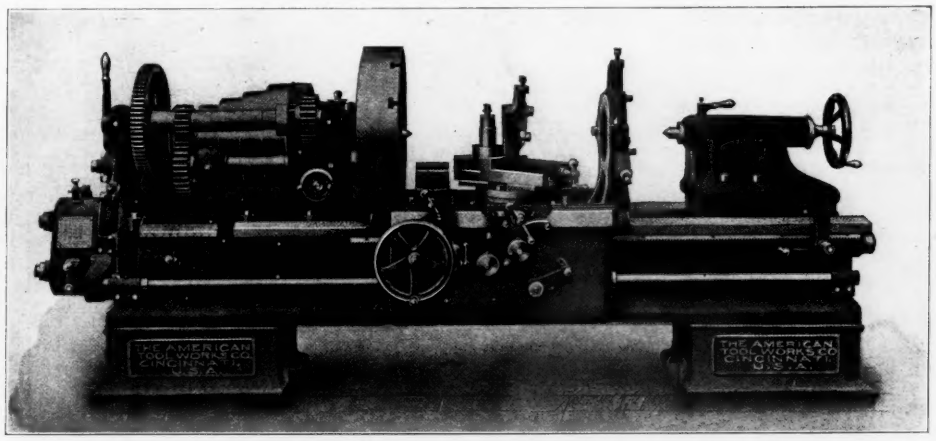
A flag standard is not a satisfactory substitute for a grab-iron.

Though a foot-hold or step on the pilot is not required by the law, inasmuch as grab-irons are considered necessary, your committee recommends the application of a convenient step on the pilot, to reduce to a minimum the danger to employees riding the pilot.

Pilot coupler braces, to be satisfactory grab-irons, should be at such a height and have sufficient clearance to be conveniently and surely reached by employees.

30-In. Lathe With Triple Geared Head.

The accompanying illustration shows the latest 30-in. lathe with triple geared head built by The American Tool Works Co., Cincinnati. The rapid change gear mechanism is on the head end of the bed. Through the four-speed box and cone a range of 36 changes for feeding and screw cutting is provided, and each change can be made while the machine is in operation, without removing any gears. Simple and complete index plates show how to obtain any thread or feed. Steel gears are used wherever necessary, and the cone of the gears is all steel.



30-inch Lathe with Triple Geared Head. Built by the American Tool Works Company.

The triple gears are the slip gear type, operated by means of a handwheel on the front of the head. All the gears have coarse pitch and wide face. The internal gear is cut integral with the face-plate and the pinion is cut solid with the shaft.

The bed has a deep section of patent drop-V pattern which allows 2 in. additional swing and has rigid construction. The spindle is high carbon special steel accurately ground with a large hole running through it. The carriage is very heavy, especially in the bridge, due to the drop-V bed, with long continuous bearing on the ways. The leadscrew is on the inside of the bed, and imparts motion to the carriage directly under the cutting tool, thus centralizing the strain and preventing twisting, such as occurs where the pull is through the apron.

German High-Speed Tests.

A speed of 125 miles an hour was attained on October 6, in the high-speed tests being conducted on the Marienfelde-Zossen experimental line near Berlin. The first series of tests in October and November, 1901, were discontinued after a speed of 99.4 m.p.h. was reached, owing to the failure of the roadbed under the excessive shock. (See *Railroad Gazette* Dec. 13, 1901.) The trials were abandoned and The Company for Experimenting with High-Speed Electric Railroads, which had been incorporated in 1899 with a capital of $178,000 to carry out the tests, applied to the Government for money to rebuild the line. The Reichstag appropriated $72,000 for the work last spring, and during the summer the line was entirely reconstructed on a substantial basis. On September 15, a new series of tests was begun.

The trials are being made on one of the outside tracks of the three-track military line just outside of Zossen. The stretch of track is 14.3 miles long and practically level. With the exception of one curve of 6,000-ft. radius near the southern end, the line is straight for the entire distance. Three-phase alternating current is obtained from the power station on the River Spree, about five miles distant, and is transmitted to the car at a tension of 13,500 volts. Transformers, mounted under the floor of the car, step down the current to 1,500 volts before it reaches the motors. Three copper trolley wires are used one above another, supported from perpendicular steel bow hangers on poles set 100 ft. apart and at one side of the track. Extending up through the roof of the car are two posts carrying three loop collectors each, held against the trolley wires by springs and through which the current is taken to the transformers.

The first tests were made on track laid with gravel ballast and 63-lb. rail of the usual section. The cars had four motors, two on each truck, an aggregate of about 1,000 h.p. At a speed of 93.2 m.p.h., the track began to fail and after a few more trials in which the speed was increased to 99.4 m.p.h., cracks appeared in the iron ties and the rails were so bent and sprung as to prohibit further experiments until the line was rebuilt. These first experiments, while disappointing in some respects, served to demonstrate the practicability of transmitting and collecting polyphase current at high-speed and of transforming it to a suitable voltage by transformers mounted on the car.

In rebuilding the line the gravel ballast was replaced by broken trap rock and the light rails were taken out. Prussian State Railroad standard 82-lb. rails 50 ft. long, were laid, for the most part with butt joints, on pine ties spaced 26 in. apart. Large hooked tie plates were used and the holes in the ties for the screws were lined with hardwood. As a precautionary measure, guard rails were laid inside the carrying rails. These consist of rails laid on their sides with the bottom flange, 2 in. inside of, and its upper edge 1¾ in. above the track rail. They are carried on cast-iron chairs, one on each tie for each rail. Up to the present time, observations show that the guard rails have not been required, which indicates that the usual form of track will give good results for speeds up to 125 m.p.h.

The accompanying engravings show the details of the track construction. Fig. 1 is a section through the rail-joint and shows the section of the rail and fish plates. The fish plates are also shown in elevation in the smaller figures. The rails have eccentric webs and are laid with the webs alternately inside and outside of the center line of the rail. With this arrangement, the head and flange of the rail can be cut away and the webs overlapped. The fish plates are 31½ in. long and have a belly in the center, 1½ in. below the foot of the rail. The outside plate comes up level with the top of the rail but the inside plate stops below the head of the rail, the bearing of both plates being on the under side of the head and on the top of the flange.

Fig. 2 shows a section through the carrying rail, guard rail and joint support; a plan of the joint support and the arrangement of ties is also shown. The tie plates to prevent creeping are put on three ties under each rail as indicated by the X on the drawing. The details of these tie plates are shown in Fig. 4.

Fig. 3 is a plan and elevation of the mitered rail joints with parallel and tapered tongues. These joints are used only on a short stretch of track about in the middle of the line where the highest speeds are attained.

Fig. 4 is a detail of the tie plates to prevent creeping of the rails. As the web is not symmetrical about the vertical axis of the rail there are two relative positions of the rail and tie plate, B, with the web outside the center line and C, with the web inside the center line of rail. In this latter position it is necessary to put in a bearing plate, A, on the outside of the web so that the same pattern of tie plate may be used throughout.

The following tables give the weights and properties of the rails and other parts.

Table I.—Working Values.

	Rail. Body.	Rail. Tongue.	Fish Plate. Outside.	Fish Plate. Inside.
Moment of inertia (inches)⁴	32.0	16.8	28.6	14.4
Moment of resistance (in.)³	11.7	6.27	7.96	4.72
Weight in pounds per yard.	81.4	47.2	80.5	64.7

Table II.—Bill of Material and Weights.

	Lbs.
2 Rails, 50 ft. Long	2,685.8
2 Outside Fish Plates, cast steel	114.6
2 Inside Fish Plates, cast steel	88.6
2 Joint Supports, cast steel	147.9
6 Tie Plates, cast steel	101.2
3 Bearing Plates	3.4
3 Chair Bolts, ⅞ in. x 2⅝ in.	4.2
3 Chair Bolts, ⅞ in. x 3⅛ in.	4.6
Weight of 50 ft. of track	3,147.3
Weight per yard of track	188.8

The cars used in the latest series of trials are practically the same as those previously used. They are 72 ft. 2 in. long and weigh about 200,000 lbs. The body and running gear weigh about 106,000 lbs., and the motors, transformers and other electrical equipment weigh 94,000 lbs. The transformers are hung under the car and weigh about 26,000 lbs. A storage battery weighing 631 lbs. is carried on the car to supply current for the lighting circuits.

The trucks under the new cars have, however, been entirely redesigned. They are 6-wheeled and each carries two motors, one on the front and one on the trailing axle, the middle wheels running free. The wheel-base in the new trucks has been increased from 15 ft. 5¾ in.

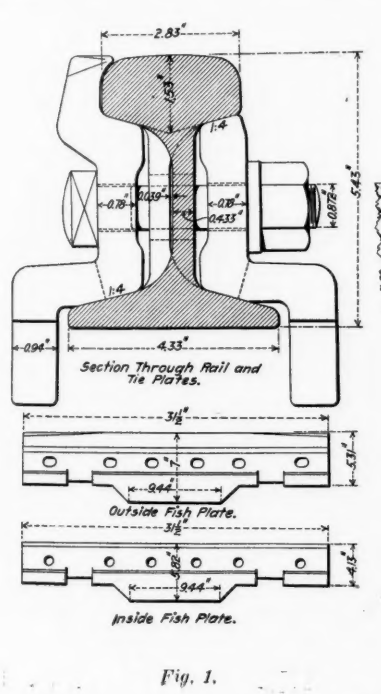


Fig. 1.

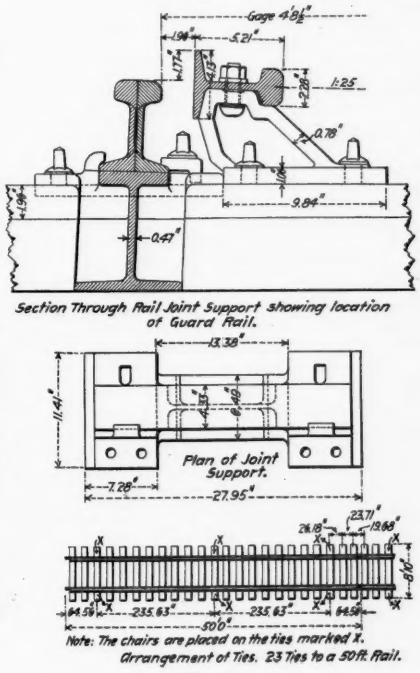


Fig. 2.

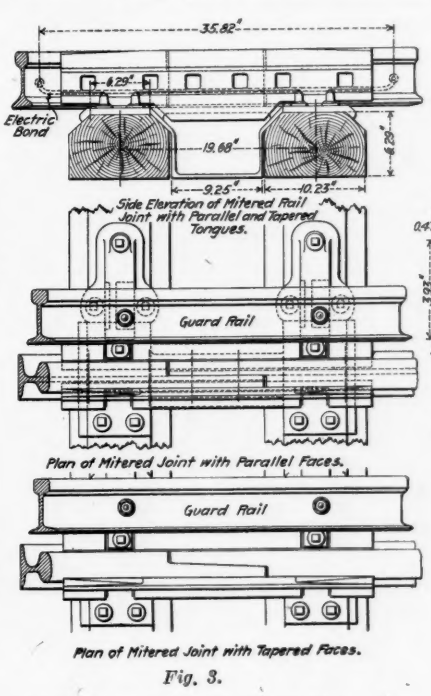


Fig. 3.

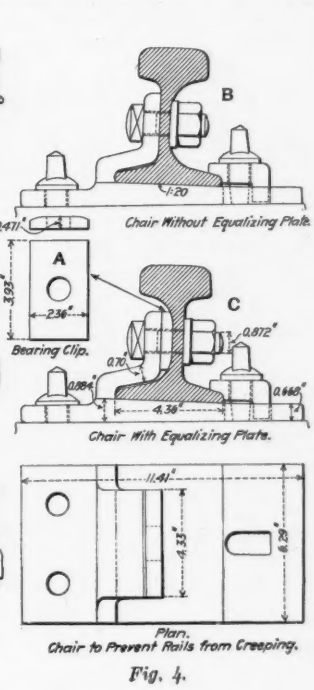


Fig. 4.

Details of Track Construction for High-Speed Electric Trials on the Berlin-Zossen Line.

to 16 ft. 5 in. and the center pins given some little side play. The frames, which in the first design partially covered the springs, have been rebuilt so that the springs are in plain view and can be easily inspected. Equalizers have also been introduced in the spring arrangement to evenly distribute the weight on all the wheels. These changes have proved entirely satisfactory, the cars running on the new tracks at the highest speeds as smoothly as they formerly did at speeds from 80 to 85 m.p.h.

The collection of current at these speeds has given but little trouble. At first when a speed of 110 m.p.h. was reached, violent vibrations were set up in the trolley wires and the poles supporting them, so that short circuits and breakages were caused. This trouble was overcome by using lighter collectors and better springs and by some slight adjustments of the overhead conductors.

Information for this description was obtained chiefly from a report by Consul General Mason at Berlin, and from an article in *Zentralblatt der Bauverwaltung* for Oct. 7.

Power-Operated Distant Signals.*

This committee, consisting of Messrs. Shaver (chairman), Elliott, Pflasterer, Peabody and Goodman, held a meeting at Chicago, April 7. In the opinion of the committee a distant signal at an interlocking plant cannot be worked automatically with success, and therefore they consider the question before them to be, "When, under various conditions, should distant signals at interlocking plants be mechanically operated, and when power operated?" A list of questions was sent out, and replies were received from 28 railroads. These questions were as below, and the replies are shown in the table following:

(1) Do you approve of power operated Distant Signals?

(2) Do you propose using power operated Distant Signals in future installations?

(3) Have recent new installations of interlocking plants on your road been provided with power operated Distant Signals?

(4) (a) How many power operated Distant Signals have you in use? (b) If any, at what distance are they located from Home Signal? (c) From tower?

Answers to Questions.

Railroad.	1	2	3	4 A	4 B Max., ft.	4 B Min., ft.	4 C Max., ft.	4 C Min., ft.
Boston & Albany	Yes	Yes	No	None	...	...	...	...
Canadian Pacific	..	..	No	None	...	...	...	...
Chicago & Alton	Yes	Yes[1]	No[2]	None	...	...	...	...
Chicago & E. I.	Yes	Yes	No[2]	None	...	...	...	...
Chicago, B. & Q.	Yes[1]	Yes[1]	No	None	...	...	...	...
Cleveland, C., C. & St. L.	Yes[1]	Yes[1]	No[2]	None	...	...	...	...
Chicago G. W.	No	No	..	2	...	...	...	...
Cincinnati, H. & D.	Yes[1]	Yes[1]	No	None	...	...	...	...
Chicago & N. W.	Yes	Yes	Yes[2]	8	1500	1200	2000	1700
Chicago, St. P., M. & O.	Yes	Yes	Yes	3	3000	1200	3400	1500
Chicago, Mil. & St. P.	Yes	Yes	Yes	9	3200	600	4100	900
Cincinnati, N. O. & T. P.	Yes	Yes	Yes	2	2775	2500	3375	2200
Delaware, L. & W.[3]	Yes	Yes	Yes	45	2000	...	2250	...
Erie	Yes[1]	Yes[1]	Yes	4	4850	1500	5000	2600
Illinois Central	Yes	Yes	No[2]	None	...	...	...	...
Lake Shore & M. S.	Yes	Yes	Yes	4	2561	1450	3084	2494
Lehigh Valley	Yes	Yes	Yes	Not given	2500	2000	...	...
Long Island	Yes	Yes	..	18	3200	1700	2700	1500
Michigan Central	Yes	Yes[1]	Yes[1]	20	3000	2500	3500	3000
New York, N. H. & H.	Yes	..	No	None	...	...	...	...
New York Cent. & H. R.	Yes	Yes	Yes[2]	.....	...	...	...	...
Northern Pacific	..	..	No	None	...	...	...	...
Pennsylvania[4]	Yes	Yes	Yes[2]	8	2500		3500	
Penna. Lines West	Yes	Yes	Yes	25	6000	1500	6000	1500
Pittsburg & L. E.	Yes	Yes	Yes	6	1600	1600	3000	2000
Southern Pacific	Yes[1]	Yes[1]	No[2]	None	...	...	...	...
Union Pacific	Yes	Yes	No[2]	None	...	...	...	...
Vandalia Line	Yes	Yes	No[2]	None	...	...	...	...

[1] In some cases. [2] Some installations planned or contracted for are to have power operated distant signals. [3] Approximate distances. [4] Average distances.

Twenty-five roads look with favor on the power operated distant signal. Only one road has had an unfavorable experience and prefers mechanical signals. Seventeen roads expect to use power operated distant signals; one road declares the usefulness of the distant signal to be still an open question, and one, on which there is a mechanical distant signal 3,840 ft. from the tower, seems to regard mechanical signals as satisfactory; the question of power operated distant signals has not been considered.

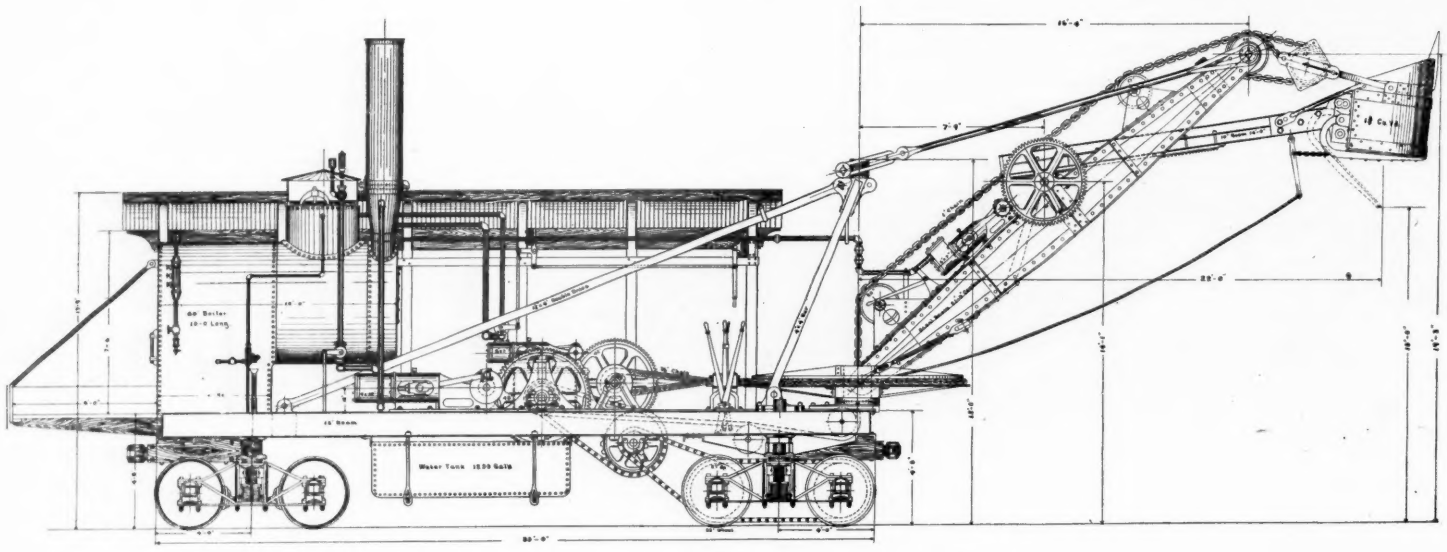
The committee, instead of going into a discussion of points which have already been considered by the club, refers to the paper by Mr. Elliott and the letter by Mr. E. M. Herr, which were read at the last annual meeting, and are printed in the Proceedings, pages 76 and 85. In conclusion, the report says:

A distant signal should be so placed that the fastest train to be controlled can be stopped easily, under the worst conditions, between it and the home signal. To fulfil these conditions safely and successfully where high speed is maintained, the power operated distant signal must be used. Where trains run at low speeds, the distant signal may be placed nearer to the home signal, but even in such cases this committee does not recommend that the signals be mechanically operated unless it be by a pipe line properly installed.

*Railway Signaling Club; Committee Report, Detroit meeting, Nov. 10.

45-Ton Boom Steam Shovel.

The Ohio Steam Shovel Company, Toledo, Ohio, has recently built a new all-metal steam shovel, a sectional elevation of which is shown herewith. It is especially adapted for railroad use in grading and filling, cutting down embankments, making heavy cuts and loading sand, gravel, broken stone, etc. It is claimed that the shovel will handle ordinary material at the rate of 1,500 to 2,000 cu. yds. in 10 hours. The dipper will dig a through cut 48 ft. wide, and has a clear lift of 14 ft. above the ground with the dipper door open. The dipper will cut 19 ft. high in a bank and 9 ft. down grade and load on flat cars. It will swing and dump five times a minute.



45-Ton Boom Steam Shovel Built By the Ohio Steam Shovel Company.

The boom is made of ¼-in. steel plate and 5-in. x 5-in. angles, 21 ft. long. The boiler is 60 in. in diameter and 10 ft. long and contains 130 2-in. tubes 4 ft. 4 in. long. The fire-box is horizontal, 48 in. long, 50 in. wide and 66 in. high inside. The boiler has 400 sq. ft. of heating surface and 16 sq. ft. grate area and is designed to carry a working pressure of 110 lbs. The hoisting engine is 40 h.p., with 9-in. x 12-in. double cylinders. The swinging engine is 15 h.p., with 6-in. x 7-in. cylinders. The thrusting engine on the boom is 12 h.p., with 6-in. x 7-in. double cylinders. The water tank is hung under the car and holds 1,250 gallons—sufficient to run the shovel half a day. The tank is fitted with a steam pipe injector for heating the water.

The car is 30 ft. long and 9 ft. wide and has four 12-in. I-beam longitudinal sills. The sill beams are supported by a heavy steel I-beam bolster truss, girted across the car and fitted with steel plates extending on both sides of the bolster with flanges riveted to the sill beams. The outer ends of the plates abut channel cross-girts to which they are riveted. This construction braces the overhang and prevents the front end of the car from sagging. The front end of the car is covered with ¾-in. steel plate, 9 ft. wide, extending back 5 ft. The car is fitted with Tower couplers. The jack arms are steel and will swing back alongside the car or can be taken off rapidly. The dipper has a capacity of 1¾ yds. and is oval in shape. The propelling rig consists of steel sprocket wheels and chain, geared 11 to 1, with a chain to both axles of the front truck which sustains two-thirds the entire weight of the shovel. The car will climb a 10 per cent. grade.

Concrete Masonry on the Lu-Han Railway.

In his description of the construction of the Lu-Han Railway (China), given in a paper before the Institution of Civil Engineers of Great Britain, Mr. Thomas J. Bourne, who was Resident Engineer for the work, includes some interesting notes on concrete masonry and concrete. Referring to the former, he says: The limestone of the available quarry was so cut up with cleavage-planes that it would furnish no stones suitable for ashlar or block-in-course masonry. The only stone available for copings, etc., was granite, which was costly to quarry, and had, moreover, to be carted to the head of the branch line. It was, therefore, out of the question for ordinary masonry, while, on the other hand, limestone, when broken down, made an excellent and cheap aggregate for concrete. The bricks of the country are wholly unsuitable for bridges and culverts.

The stone for concrete was broken by hand, so that an average piece would pass through a 2-in. ring. The proportion of spalls being small and the percentage of voids in such stone being too great to give an economical concrete, the larger stones were picked out, or small rubble was used, being broken down to pass through a ½-in. sieve; this was done at a piece-work rate. In gaging the concrete a proportion of this fine stuff was added, displacing so much mortar in the voids of the larger stones and giving a greater bulk of concrete for the same amount of cement and the same strength of mortar, besides a more homogeneous and freer mixture, with less chance of voids in the finished work and greater capacity for consolidation under the rammer and for taking the form of the mould. A mixture composed of 1 of cement to 4 of sand and 8 of broken stone, with 1 of ½-in. chips, is for convenience described as 1—4—(8+1), and this gaging was used for box-culverts, U-shaped abutments, and abutments of arches. Piers were made of 1—3½—(7+1) concrete, and arch-rings and foundation-blocks over piles of 1—3—(6+1) concrete. In every case a layer, 1 foot in thickness, of 1—2—(3+1) concrete was laid under the bed-plates of girders. The consumption of cement for the 90 miles of line was some 44,000 barrels, most of this being of German manufacture, "Alsen" brand, packed in iron drums with wooden ends. All concrete work was kept wet for 6 to 10 days by pouring and sprinkling water over it. In the 21-ft. piers at Liu Li Ho, three holes, each 6 in. in diameter, were carried up on the center line of the piers from the top of the plinth to bedstone level, and were kept filled with water for about the same time to insure the work thoroughly setting, being afterwards plugged.

The question of wet versus dry mixing of concrete is mainly an academic one. Whatever the relative value under laboratory tests of a "driest possible" and a wet mixture may be—and this is sufficiently clear from tension tests of both neat cement and mixtures—in actual work, where concrete must be rapidly mixed by hand and placed in large quantities, there is practically no great variation possible in the amount of water used. Enough must be used to make the labor required in turning moderate, to make the mixture thoroughly plastic, and to insure the mortar getting in freely between the stones under the rammer or shovel: but so much must not be used that water and slurry collect on top of the work, or that the fluid mortar carries the cement away through spaces in the shuttering, etc. These conditions practically fix an exact proportion of water. Again, in laboratory work the briquette is always given opportunity to absorb water for setting, whereas in massive construction above water-level only the surface layers can be expected to receive more water than is given in the original mixing.

Most of the concrete work was done in hot weather, and set rapidly in consequence, and no extended ramming was possible. Plums of rough limestone-rubble were used where the structure was not subject to direct or considerable transverse stress. They were employed in abutments and piers, but not in foundation-blocks or footing-courses, and were placed so as never to be nearer to the face or to

one another than 6 in. in any direction. The stones were soaked in water and then thrown down on, and rammed into, a soft mass of newly laid concrete.

In some few cases it was necessary to continue the concrete work of minor bridges after the frost had set in, in order to avoid delay to the track or the employment of diversions. This was done by carrying out the work on fine days under the hot winter sun, boiling the water of mixture and dissolving 8 per cent. of salt in it and covering the work over each night with a thick layer of straw. Such work has stood well, and only in one case, where the salt or firewood was probably stolen and the work scamped, was it necessary to take down some few feet of a small pier which was found to be touched by frost. The Alsen cement used was packed in sheet-iron drums with ½-in. wooden ends, which were necessary, to stand the tests of transport under Chinese conditions and the exigencies of weather and storage. In no case, except that just referred to, had any concrete to be condemned, or were any cracks due to unsoundness of cement discovered.

General Note on Concrete. The author would here call attention to two apparent anomalies in the general conception of concrete as a material in competition with other masonry:

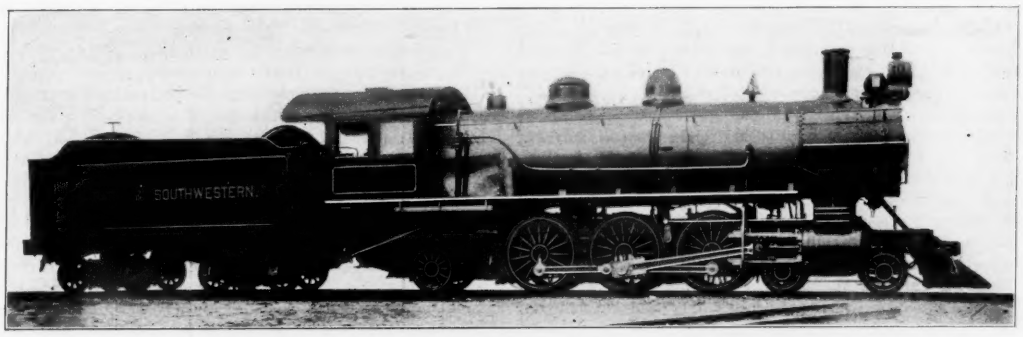
1. Concrete appears almost always to be judged and compared with other masonry by its compressive strength, whereas its ultimate test is rarely that of direct compression. Cracks and failures in masonry, whatever the first cause may be, whether from unequal foundations, unequal loading, or direct transverse stress as in a masonry or concrete beam, are almost invariably caused by cross breaking stress or shearing stress, and therefore, in effect, by tensional weakness or weakness in shear.

2. Although compressive stress is the test adopted, and although concrete generally gives a higher value thus tested than brickwork in cement, still brickwork, at two or three times the cost of concrete, continues to be regarded as a more reliable material.

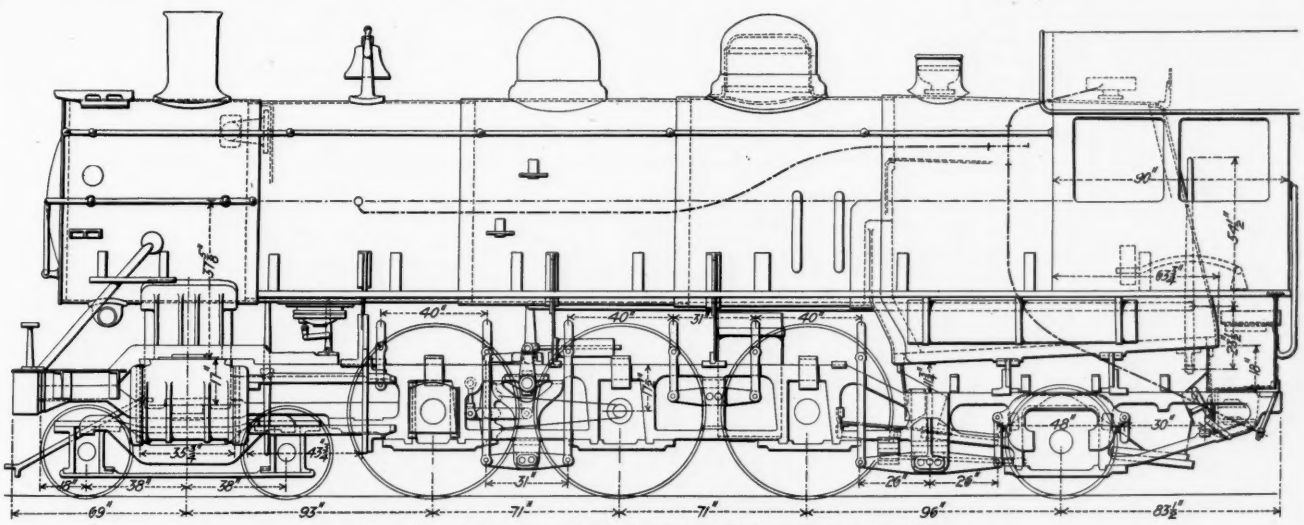
The author is of opinion that the transverse breaking-strength of beams having a depth equal to one-quarter to one-half their bearing-length is the best test of materials for masonry work, and if this is true, it seems certain that even poor cement-concrete should be preferred to brick much more often than is the case.

Heavy Pacific-Type Locomotives for the El Paso & Southwestern.

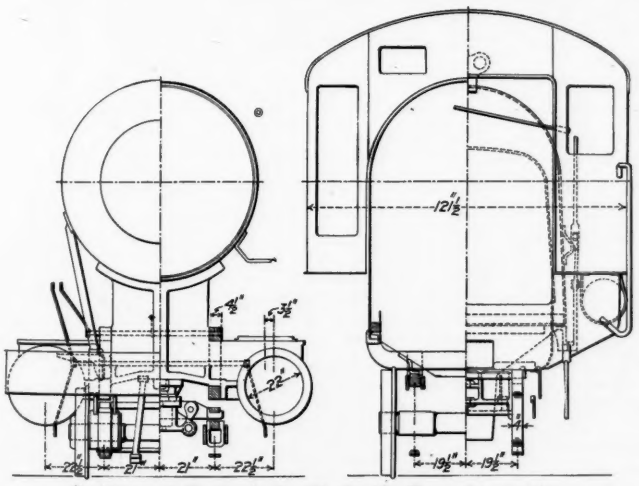
The El Paso & Southwestern has received from the Baldwin Works two of an order of four heavy Pacific type locomotives; the remaining two are to be delivered in February. The photograph shows them to be quite similar in their lines and general appearance to the heavy Pacific type passenger engines of the Chicago & Alton; and, in fact, they were built practically to the same specifications, allowing for difference of service and operating conditions; for the El Paso & Southwestern locomotives are for fast freight service. The chief points in which they differ from the Alton engines are in the smaller drivers, shorter stroke and lower boiler pressure. Their total weight is also nearly 10,000 lbs. less. The purpose of the road in selecting this design for fast freight service was to enable it to run 1,000-ton gross load freight trains over its line having 1 per cent. ruling grades, on a 15 m.p.h. schedule.



Pacific Type (4-6-2) Locomotive for the El Paso & Southwestern.



Elevation of El Paso & Southwestern Pacific-Type Locomotive.



Sections of E. P. & S. W. Pacific-Type Locomotive.

Assuming a speed of 10 m.p.h. on the 1 per cent. grades, a train resistance of 4.5 lbs. per ton $\left(\frac{V}{4}+2\right)$, a grade resistance of 20 lbs. per ton for the train, and an additional 20 lbs. per ton for the locomotive with a half load of coal and water (150 tons), the total resistance comes to 27,500 lbs. The maximum available tractive power of the locomotive is 33,950 lbs. On grades, allowing for various contingencies, it is fair to assume that 80 per cent. of the maximum tractive force is available, which gives 27,200 lbs., showing that these locomotives should be able to maintain a 10-m.p.h. speed on the long 1 per cent. grades they encounter. The two already in service have proven their ability to do this.

The main line of the El Paso & Southwestern is laid with 75-lb. rails, with the exception of one short stretch which has lighter rails. The water for locomotive supply is obtained entirely from wells and is unusually good, though some of it has small amounts of alkalies, causing foaming, though not to any serious extent.

Following are the general dimensions:

Weight on drivers	132,500 lbs.
Weight on front truck	36,800 lbs.
Weight on rear truck	40,200 lbs.
Weight, total, engine	209,500 lbs.
Weight, engine and tender	340,000 lbs.
Wheel-base, total, of engine	30 ft. 9 in.
Wheel-base, driving	11 ft. 10 in.
Wheel-base, total (engine and tender)	60 ft. 7½ in.
Heating surface, fire-box	184.5 sq. ft.
Heating surface, tubes	3,634.0 sq. ft.
Heating surface, total	3,818.5 sq. ft.
Grate area	52¼ sq. ft.
Drivers, diameter	63 in.
Truck wheels, front, diameter	33 in.
Truck wheels, rear, diameter	40 in.
Journals, driving axle, size	10 in. x 12 in.
Cylinders, diameter	22 in.
Piston, stroke	26 in.
Valves, kind of	Balanced

Boiler.

Type	Straight
Working steam pressure	200 lbs.
Material in barrel	Steel
Thickness of material in barrel	¾ in.
Staying	Radial
Fire-box, length	9 ft. 6 in.
Fire-box, width	5 ft. 6 in.
Fire-box, depth front	75 in.
Fire-box, depth back	65¾ in.
Fire-box, material	Steel
Fire-box, thickness of sheets	⅝ in. and ½ in.
Fire-box, water space, width:	Front, 4 in.; sides, 3½ in.; back, 3½ in.
Tubes, number	318
Tubes, material	Iron
Tubes, outside diameter	2¼ in.
Tubes, length over sheets	19 ft. 6 in.
Tank capacity for water	7,000 gals.

Progress of Power Signaling in England.

BY CHARLES H. GRINLING (*London*).

The first English experiment in operating railroad signals otherwise than by manual and mechanical power was made on the Liverpool Overhead Electric Railway, which since its opening in 1893 has been worked by electric automatic signals except at the termini, where interlocking frames of the ordinary mechanical type are provided to control the shunting of the trains. There are 12 intermediate sets of block signals which are automatically operated by means of "long-pole" electro-magnets, the invention of Mr. Illius A. Timmis, an English engineer. Mr. Timmis was also concerned with Mr. F. W. Webb, chief mechanical engineer of the London & North Western, and Mr. A. M. Thompson, electrical engineer of that road, in working out the "Crewe system" of all-electric power signaling, the first experimental installation of which was completed in the freight sidings at Crewe in January, 1898. The whole of these extensive sidings are now electrically signaled from cabins containing in all nearly 1,000 levers. The semaphores and ground disk signals and also the trailing points are operated by the Timmins long-pole magnet, and, in the case of the signals, counterbalancing weights are provided so that, as soon as the current is cut off, they fly back to danger. The facing points are worked by electric motors of a type specially designed and constructed at Crewe, which operate through a worm-gear with right and left-handed clutch for moving the switch and locking rods. One of these motors is provided to each set of facing points. The electric current is supplied from the station lighting generator at 110 volts. The amount of power required is small, 50 amperes being computed to be the maximum demand for the largest cabins. The Crewe system is represented commercially in the United Kingdom by the Railway Signal Company of Fazakerly, Liverpool. This company has recently completed a contract for the North Eastern for an installation in one of the largest cabins, controlling freight sidings, near York. This cabin is known as Severus Junction. The "Crewe" system of power signaling has not so far been applied to passenger lines, but Mr. Webb publicly stated not very long ago that it was the intention of the London & North Western to do so. Mr. Webb has since retired from the position of chief mechanical engineer of the road, but his co-inventor, Mr. A. M. Thompson, is still superintendent of the signaling department. No other system of power signaling has so far had a trial on the North Western.

The well-known Westinghouse electro-pneumatic system was first introduced into England on the Great Eastern by the instrumentality of a director of that road, Sir H. W. Tyler, who was formerly one of the inspecting officers of the Board of Trade and afterwards president of the Grand Trunk of Canada. The plant for the Great Eastern box was made in America and then shipped piece-

meal to England, where it was put together and installed by Messrs. McKenzie & Holland, the well-known English signaling firm. This installation, like those at Crewe, is in a freight yard, viz.: at Bishopsgate, London, which is the London terminus for the freight traffic of the line. The cabin contains a 47-lever frame, and it commenced work on Jan. 15, 1899. The Great Eastern has not adopted this or any system of power signaling at any other part of its line; but two other English roads—the North Eastern and the Lancashire & Yorkshire—have contracted for electro-pneumatic installations, and both these companies are now using this system on passenger lines, although the North Eastern's installations are primarily for working mineral and goods traffic. At Tyne Dock, the well-known coal-shipping station on the North Eastern, there are three electro-pneumatic signal cabins, which were opened respectively in July, 1902; September, 1902, and April, 1903. They contain 29, 66 and 30 levers respectively. The most recent, and the most important installation of the Westinghouse system in England is that of the Lancashire & Yorkshire at Bolton passenger station, which has just been brought into use. It contains 83 levers and is the first English example of the use of the electro-pneumatic system on a large scale for the control of passenger trains. The Lancashire & Yorkshire authorities purchased the patented parts from the Westinghouse Air-Brake Company in London and put together the installation themselves.

In the summer of 1900 Mr. John N. Beckley came over from America to Europe with the object of introducing the low-pressure pneumatic or "all-air" system of signaling into England and the Continent. Mr. Beckley quickly fixed up an arrangement for this system to be represented in Europe by Mr. John P. O'Donnell, of the firm of Evans, O'Donnell & Co., signal engineers of London and Chippenham. This firm has since amalgamated with Saxby & Farmer under the title of "Saxby & Farmer Ltd." For the purpose of exploiting the "all-air" system a separate undertaking was formed under the title of the "British Pneumatic Railway Signal Co.," with Mr. O'Donnell as chairman. Considering the comparatively short time it has been in the field and the conservatism of English railroad methods, this undertaking has made very considerable progress. Two of the leading officials of the London & South Western, Mr. Sam Fay, superintendent of the line (who has since become general manager of the Great Central), and Mr. Jacomb-Hood, chief engineer, after a visit to America in 1900, during which they studied all the power systems then in vogue, recommended their directors to adopt "all-air" in a new cabin which was about to be built on the London & South Western main line at Grateley, in connection with the opening of a short branch from that place. This was a 72-lever cabin and it was opened in July, 1901, in the presence of representatives of all the leading British lines, who besides inspecting the signaling installation enjoyed the pleasure of hearing an oration from Mr. Chauncey M. Depew. Following the Grateley installation the London & South Western soon decided to place two similar installations at Salisbury, a much larger station which was about to be remodeled, and these were completed about a year ago. A detailed description of the Salisbury plant appeared in the *Railroad Gazette*. Within a year, too, of the opening of the Grateley cabin, the London & South Western gave to the British Pneumatic Company by far the largest power-signaling contract yet let in the United Kingdom, namely, for the installation of the low-pressure system on its main line between Woking and Basingstoke, a distance of 24 miles, including eight pneumatic interlocking plants averaging 70 levers each. It should be stated that, in connection with the Grateley plant, a small experimental installation of automatic signaling was laid down in 1901 between Grateley and Andover, the low-pressure air valves being operated by a track circuit. Mr. Jacomb-Hood, the engineer of the road, stated last June at the Engineering Conference in London that they had not had a single failure of these automatic signals in 18 months' experience. Thirty-one sets of these automatic signals are now being erected in connection with the widening of the South Western main line between Woking and Basingstoke, the semaphores being placed on bridges spanning the four tracks. The British Pneumatic Company has also in hand a contract—the first in England for which tenders were openly invited—for the installation of its system of power and automatic signals at Staines Junction on the London & South Western. Here two "all-air" cabins are being erected to do work which would require four or five equipments of the manual type. It should be stated that in connection with the introduction of power signaling the British Board of Trade has considerably increased the distances at which it will allow switches and signals to be worked, the limit for facing points, for example, having been increased from 200 to 300 yards. Six miles of track circuit also is being laid down at Staines for the automatic returning of the levers to normal—that is the "electric slot." The North Eastern intends soon to have an installation of the British Pneumatic system, so as to give a fair trial to each of three competing methods.

In regard to automatic signaling the leading officials of the North Eastern, when they visited America in 1901, were favorably impressed with the Hall system, and they entered into a provisional agreement with the Hall company to lay down an experimental installation on 11 miles of their main line north of York. Some detail difficulties, however, arose, and it was not until after a second deputation of North Eastern officers had visited America in 1892, that this contract was finally sealed. As a result of this delay, it was decided to adopt compressed carbonic acid gas for lowering the semaphores instead of electric motors, as originally intended, the gas valves being opened by track circuit. Automatic signaling by track circuit has been recently installed by the Westinghouse Brake Company on the electric section of the Metropolitan District Railway between Ealing and South Harrow, near London. This equipment, which includes the automatic train-stop, is the second example of an electric railway being signaled automatically by means of track circuit, the only other installation being at Boston, Mass. The British Pneumatic is also arranging to install about 12 automatic block sections on this line, which is being used by Mr. Yerkes as a sort of trial-ground for testing various types of apparatus, with a view to deciding which are the best to adopt on his system of "tubes" now under construction and on the electrified district. Messrs. Spagnoletti also have a system of automatic signaling for tube railroads in the market, which is being installed on the Great Northern & City line, a road outside the Yerkes group, shortly to be opened for traffic. Trials of the Spagnoletti system are also taking place on the Central London. To prove that track circuits can be relied upon even under the most unfavorable conditions the British Pneumatic recently laid one down through the Woodhead tunnel of the Great Central, which is over three miles long and exceedingly damp. It is expected that this road will be the next to adopt automatic signaling on an extensive scale. The Great Central recently allowed the Miller Cab Signaling syndicate to give a demonstration of its system. A system combining the operation of signals by electric motors with the working of switches by manual power has just been installed at the St. Enoch's Station, Glasgow (Glasgow & South Western), by the W. R. Sykes Interlocking Signal Co., which company has also obtained a contract at the Folkestone Station of the South Eastern & Chatham. The company (of which Major-General Hutchinson, formerly chief inspecting officer of the Board of Trade, is chairman,) was formed some years ago to exploit the Sykes "lock and block" system, which, however, seems to be in danger of being superseded by automatic track circuit signals.

Foreign Railroad Notes.

A Prussian railroad regulation requires that before an employee gives the signal for a train to enter a station he must ascertain that the track is clear in front of it. In one case, a station officer ordered the drillmaster to switch a baggage car from the main track in front of the station, which would have cleared the track for the following train. Assuming that his order had been obeyed, he signaled line clear. But the baggage car had not been moved, and the entering train ran into it. Tried for negligence in signaling line clear, the station man was acquitted by the trial court, which held that he had a right to assume that his order had been obeyed; but on appeal the imperial court reversed the decision, holding that the rule that he should "ascertain" that the line is clear, means that he should see for himself, go where he can see, and if it is not light enough find out by feeling.

The Belgian State Railroad authorities, moved thereto by some recent accidents, have given notice to enginemen, firemen and signalmen, that hereafter violations of the rules will be followed by immediate suspension, and, unless on investigation, grave reasons do not excuse their acts, by final dismissal from the service.

American Railway Association.

This Association held its fall session at Richmond, Va., October 28. There were present 84 delegates, representing 61 members, and President A. W. Sullivan occupied the chair.

The Executive Committee reported that the membership of the Association now comprises 279 members, operating 211,664 miles, an increase of four members and of 1,347 miles. The question of the proper design and construction of tank cars for the safe transportation of volatile oils, and action taken by the Master Car Builders' Association in connection therewith, was also referred to in the report of the committee. The Association voted that to be admitted to membership a road must be a common carrier, dependent upon its revenue from transportation. Railroads are ineligible to membership, whether incorporated or not, which are used primarily to transport the material or product of an industry or industries to and from a point on a railroad which is a common carrier, or those which are merely adjuncts to such industries."

Several amendments to the Articles of Organization and Sections of the By-Laws were submitted, which will come up for action next April.

Section 8 of the By-Laws was amended so as to have the President and Second Vice-President elected in April, and the First Vice-President in October.

The Association adopted the following:

Rules Governing the Movement of Trains with the Current of Traffic on Double Track by Means of Block Signals.

1. On portions of the road so specified on the time-table, trains will run with the current of traffic by block signals whose indications will supersede time-table superiority.
2. The movement of trains will be supervised by the ——* who will issue instructions to signalmen when required.
3. A train having work to do which may detain it more than —— minutes, must obtain permission from the signalman at the last station at which there is a siding before entering the block in which work is to be done. The signalman must obtain authority to give this permission from the ——*
4. Except as affected by these rules, all Block Signal and Train Rules remain in force.

*Superintendent or Train Despatcher.

The Committee on Safety Appliances reported progress in formulating rules governing the determination of physical and educational qualifications of applicants for employment.

The Committee on Statistical Inquiry reported that a large amount of data has been obtained, and that considerable work has been accomplished.

The Committee on Standard Cipher Code reported progress. The committee finds it will require a longer time to complete the task than had been anticipated.

The Committee on Car Service submitted a number of amendments to the Code of Per Diem Rules and the Code of Car Service Rules. The rules as revised by the committee, with a single unimportant exception, were adopted by the Association, to take effect on Jan. 1, 1904. Interpretations of the per diem rules by the Arbitration Committee were approved.

Mr. A. H. Smith, General Manager of the New York Central, and Major E. T. D. Myers, President of the Richmond, Fredericksburg & Potomac, were elected members of the Committee on Nominations.

The Buffalo & Susquehanna, the Delaware, Lackawanna & Western, and the Wabash were re-elected members of the Committee on Car Service.

The Chicago & North Western, the Cleveland, Cincinnati, Chicago & St. Louis, and the Philadelphia & Reading were re-elected members of the Committee on Safety Appliances. The next meeting of the Association will be held in New York City on April 27, 1904.

Cost of Line Wires for Automatic Signals.*

In November, 1902, your committee . . . concluded that copper wire of certain gages should be recommended. In order to make the above named report more comprehensive, we quote the data in Tables 1 and 2. (All the items refer to wire with Doublebraid weather-proof insulation.)

Table 1.—Cost of Wire Lines on Poles for Signaling.

Reference to Table 2.	Gage.	Weight per mile.	Cost per pound, cents.	Ohms per mile.	Labor per mile.
A	8BWG	483 lbs.	4.5	12	$5.00
B	10BWG	350 lbs.	4.5	18	5.00
C	12BWG	158 lbs.	13	8	4.00
D	10BWG	238 lbs.	13	5½	4.00

Table 2.—Statistics of Certain Installations.

Miles track protected.	Miles and kind of wire.	No. of signals.	To install per mile—Wire & Labor.*	To install per mile—Battery material.	To maintain battery per mile per yr.†
5½	5½A, 5½B	4	$23.83	15 cells, $30.00	$18.00
30	30A, C0C	13	25.27	11 cells, 22.00	13.20
39½	39½A, 39½B, 39½C	19	24.10	10 cells, 20.00	12.00
108½	108½D, 217C	37	28.00	8 cells, 16.00	9.60
29	29D, 29C	13	29.75	8 cells, 16.00	9.60

*This item indicates cost exclusive of pole line and fixtures. †This represents an average delivery of .120 amperes of current through the circuit, *i. e.*, from battery to common wire through relay and other contacts through signal instrument magnets, through signal circuit back to battery, for distances, in feet, to correspond with our previous reports.

For reasons shown in the tabulated statement, we respectfully recommend that copper wire be adopted as the standard for signaling circuits. While the first cost per mile is a little in excess of iron, the saving in installation of battery and the cost of maintenance, both material and labor, soon more than offset that factor.

In addition to this, the lasting quality of copper as compared with iron, the difference in the weight that the poles and cross arms have to carry, the reduced liability of failures due to broken jars, loose connections or exhausted cells, and the smaller chance of failures due to defective joints in the line wire are all in favor of copper.

H. S. Balliet, W. A. D. Short, C. S. Rhoads, S. K. Bullard, C. Selden, Committee.

*Railway Signaling Club; Committee Report, Detroit meeting, Nov. 10.

Foundation Brake Gear for High-Pressure Control.

The Master Car Builders' Association standard details of foundation brake gear for freight cars were adopted in 1889 and with the exception of a few minor changes still remain as adopted, although entirely inadequate to resist the stresses imposed by increased air pressures acting through 10 in. x 12 in. cylinders which are in use

at the present time on nearly all heavy freight equipment. The increase in cylinder pressure from 50 lbs. or 55 lbs. to 77 lbs. with the high-pressure control system has been necessary to provide sufficient power to control long heavy trains on steep grades, but this has not been accompanied with a corresponding increase in the dimensions of the foundation gear transmitting this heavy pressure to the brake-shoes. Brake-shoes and beams have been designed to withstand increased pressure and the failures in the brake rigging naturally occur in the next weakest members, the connections between cylinders and beams.

Last year a committee of the Association working in conjunction with the Westinghouse Air-Brake Company, prepared designs of foundation brake gear suitable for high-speed brakes under 8 and 12-wheel passenger cars. These designs were presented in a report to the convention last June and have since been adopted by letter ballot as Recommended Practice. (See *Railroad Gazette*, 1903, p. 491.) The manufacturers carried the investigation still farther and prepared designs for all weights of tenders and freight cars suitable for the high-speed brake or the high-pressure system of control known as their Schedule "U." The company's designs for passenger cars differ slightly in detail from those adopted by the Association and are shown here for that reason. The designs for tenders and freight cars are much stronger than the present standards and have been worked out from the same fundamental assumptions as were used in committee report for passenger cars with the exception of the maximum cylinder pressure.

Eight schedules in all have been prepared, one for 6-wheel trucks, two for 4-wheel passenger trucks, two for tenders and three for freight cars. Each is based on maximum and minimum limits for the light weight of car. The accompanying tables and diagrams give all the principal dimensions for each schedule, the fixed lengths of the levers being given on the diagrams, the variable lengths of cylinder lever arm in the small tables with each diagram, and the dimensions of the parts in the large table.

The following fundamental assumptions were used in all the designs:

Braking power to be 90 per cent. of the light weight of the car for passenger equipment, 70 per cent. for freight equipment, and 100 per cent. for tenders.

Maximum stress in levers, 23,000 lbs. per sq. in.

Maximum stress in rods, except jaws, 15,000 lbs. per sq. in.

Maximum stress in jaws, 10,000 lbs. per sq. in.

Maximum shear on pins, 10,000 lbs. per sq. in.

Maximum pressure in brake cylinder, 86 lbs. per sq. in. for passenger cars and tenders, 77 lbs. per sq. in. for freight cars for high pressure control with 90 lbs. train line pressure.

Diameter of pins to provide a bearing value not to exceed 23,000 lbs. per sq. in.

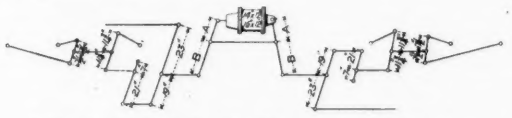


Table I.—6-wheel Trucks, Passenger; Schedule I.

Cylinder levers for cars weighing. 80,000 lbs. to 93,500 lbs. 14 in. x 12 in. brake cylinder. 90 per cent. braking power.			Cylinder levers for cars weighing 93,500 lbs. to 134,000 lbs. 16 in. x 12 in. brake cylinder. 90 per cent. braking power.		
Weight.	A	B	Weight.	A	B
81,000	13½	22½	96,000	12¾	23¼
83,500	13¾	22¼	99,000	13	23
86,000	14	22	102,000	13¼	22¾
88,500	14¼	21¾	105,000	13½	22½
91,000	14½	21½	108,000	13¾	22¼
93,500	14¾	21¼	111,500	14	22
			115,000	14¼	21¾
			118,500	14½	21½
			121,500	14¾	21¼
			125,000	15	21
			129,000	15¼	20¾
			133,000	15½	20½

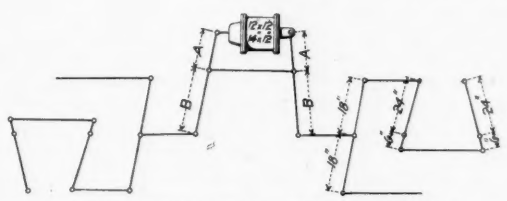


Table II.—4-wheel Trucks, Passenger; Schedule II.

Cylinder levers for cars weighing 50,000 lbs. to 68,000 lbs. 12 in. x 12 in. brake cylinder. 90 per cent. braking power.			Cylinder levers for cars weighing 68,000 lbs. to 90,000 lbs. 14 in. x 12 in. brake cylinder. 90 per cent. braking power.		
Weight.	A	B	Weight.	A	B
50,000	13¼	19¾	70,000	13½	19½
52,000	13½	19½	72,000	13¾	19¼
53,500	13¾	19¼	74,000	14	19
56,000	14	19	76,000	14¼	18¾
57,000	14¼	18¾	78,000	14¼	18¾
58,500	14½	18½	80,000	14½	18½
60,000	14¾	18¼	82,500	14¾	18¼
62,000	15	18	85,000	15	18
64,000	15¼	17¾	87,500	15¼	17¾
66,000	15½	17½	90,000	15½	17½
68,000	15¾	17¼			

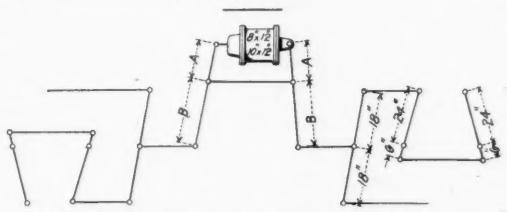


Table III.—4-wheel Trucks, Passenger; Schedule III.

Cylinder levers for cars weighing 15,000 lbs. to 30,000 lbs. 8 in. x 12 in. brake cylinder. 90 per cent. braking power.			Cylinder levers for cars weighing 30,000 lbs. to 50,000 lbs. 10 in. x 12 in. brake cylinder. 90 per cent. braking power.		
Weight.	A	B	Weight.	A	B
15,000	10¼	22¾	31,500	12¼	20¾
16,500	10¾	22¼	33,000	12¾	20¼
18,000	11½	21½	34,500	13	20
19,500	12	21	36,000	13½	19½
21,000	12¾	20¼	37,500	13¾	19¼
22,500	13¼	19¾	39,000	14	19
24,000	13¾	19¼	40,500	14¼	18¾
25,500	14¼	18¾	42,000	14¾	18¼
27,000	14¾	18¼	43,500	15	18
28,500	15	18	45,000	15¼	17¾
30,000	15½	17½	46,500	15½	17½
			48,000	15¾	17¼
			49,500	16	17

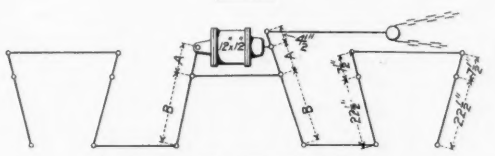


Table IV.—Tenders, Schedule IV.

Cylinder levers for tenders weighing 47,000 lbs. to 68,000 lbs. 12 in. x 12 in. brake cylinder. 100 per cent. braking power.

Weight.	A	B	Weight.	A	B
47,000	10	23	59,000	11½	21½
48,500	10¼	22¾	60,500	11¾	21¼
50,000	10½	22½	62,000	12	21
51,500	10½	22½	63,500	12¼	20¾
53,000	10¾	22¼	65,000	12¼	20¾
54,500	11	22	66,500	12½	20½
56,000	11¼	21¾	68,000	12¾	20¼
57,500	11½	21½			

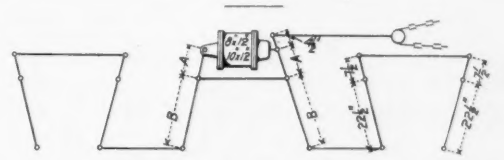


Table V.—Tenders, Schedule V.

Cylinder levers for tenders weighing 15,000 lbs. to 30,000 lbs. 8 in. x 12 in. brake cylinders. 100 per cent. braking power.			Cylinder levers for tenders weighing 30,000 lbs. to 47,000 lbs. 10 in. x 12 in. brake cylinders. 100 per cent. braking power.		
Weight.	A	B	Weight.	A	B
15,000	7¾	25¼	31,500	9¾	23¼
16,500	8¼	24¾	33,000	10	23
18,000	9	24	34,500	10¼	22¾
19,500	9½	23½	36,000	10½	22½
21,000	10	23	37,000	11	22
22,500	10½	22½	39,000	11¼	21¾
24,000	11	22	40,500	11½	21½
25,500	11¼	21¾	42,000	11¾	21¼
27,000	11¾	21¼	43,500	12	21
28,500	12¼	20¾	45,000	12¼	20¾
30,000	12½	20½	46,500	12½	20½

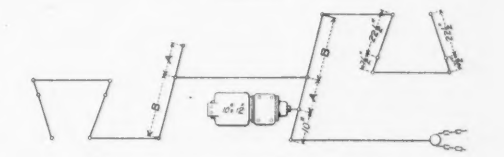


Table VI.—Freight Cars, Schedule VI.

Cylinder levers for cars weighing 40,000 lbs. to 50,000 lbs. 10 in. x 12 in. brake cylinders. 70 per cent. braking power.

Weight.	A	B	Weight.	A	B
40,000	9	24	46,000	10	23
41,000	9¼	23¾	47,000	10¼	22¾
42,000	9¼	23¾	48,000	10¼	22¾
43,000	9½	23½	49,000	10½	22½
44,000	9¾	23¼	50,000	10½	22½
45,000	9¾	23¼			

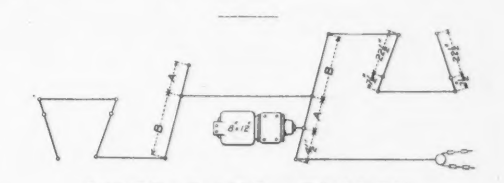


Table VII.—Freight Cars, Schedule VII.

Cylinder levers for cars weighing 16,000 lbs. to 40,000 lbs. 8 in. x 12 in. brake cylinders. 70 per cent. braking power.

Weight.	A	B	Weight.	A	B
16,000	7½	32½	28,000	9½	23½
17,000	8	32	29,000	9¾	23¼
18,000	8¼	31¾	30,000	10	23
19,000	8¾	31¼	31,000	10¼	22¾
20,000	7½	25½	32,000	10½	22½
21,000	7¾	25¼	33,000	10¾	22¼
22,000	8	25	34,000	11	22
23,000	8¼	24¾	35,000	11¼	21¾
24,000	8½	24½	36,500	11½	21½
25,000	8¾	24¼	38,000	11¾	21¼
26,000	9	24	39,000	12	21
27,000	9¼	23¾	40,000	12¼	20¾

Item.	Passenger Cars. Schedule 1.*	Schedule II.	Schedule III.	Tenders. Schedule IV.	Schedule V.	Freight Cars. Schedule VI.	Schedule VII.	Schedule VIII.
1 Light weight of car, pounds	80,000 to 134,000	47,000 to 93,000	15,000 to 47,000	47,000 to 68,000	15,000 to 47,000	40,000 or greater	15,000 to 40,000	15,000 or less
2 Maximum pressure in brake cylinder, lbs. per sq. in.	85	85	85	85	85	76.5	76.5	76.5
3 Size of brake cylinder	14 x 12-16 x 12	12 x 12-14 x 12	8 x 12-10 x 12	12 x 12	8 x 12-10 x 12	10 x 12	8 x 12	6 x 8
4 Maximum total pressure in brake cylinder, lbs.	13,085 and 17,085	9,600 and 13,085	4,290 and 6,676	9,600	4,290 and 6,676	6,047	3,870	2,177
5 Cylinder lever, greatest width	8½	7	5½	6	5	4	3	3
6 Cylinder lever, least width	3	2½	2½	2½	2½	2½	2½	2
7 Cylinder lever, thickness	1	1	1	1	1	1	1	¾
8 Floating lever, greatest width	6½	7	5½	6	5	4	3½	3
9 Floating lever, least width	2½	2½	2½	2½	2½	2½	2½	2
10 Floating lever, thickness	1	1	1	1	1	1	1	¾
11 Truck lever, greatest width	8½	5½	4½	6	5	4	3¾	3
12 Truck lever, least width	3¾	2½	2½	2½	2½	2½	2½	2
13 Truck lever, thickness	1¼	1¼	1	1	1	1	1	¾
14 Push rod, diameter	.....	.....	.....	1½	1½	1½	1½	1⅜
15 Push rod, shortest length	.....	.....	.....	26	26	26	26	19¾
16 Cylinder lever connection rod, diameter	1⅝	1½	1⅛	1¼	1	⅞	⅞	¾
17 Top connection rod, diameter	2¼	⅞	⅞	⅞	⅞	¾	¾	¾
18 Bottom rod, diameter for tension	1⅝	1⅜	1⅛	1⅛	1⅛	1	¾	¾
19 Bottom rod, diameter for compression	.....	2⅜	2	2	2	1½	1½	1⅜
20 Hand brake connection rod, diameter	⅞	⅞	⅞	⅞	⅞	¾	¾	¾
21 Sizes of pin connection holes	1¼, 1¾, 1½, 2	1⅛-1⅜	1⅛	1¼-1⅜	1⅛	1⅛	1⅛	1
22 Hodge lever, greatest width	6	5½	4½	.....	.....	.....	.....	.....
23 Hodge lever, least width	2½	2½	2½	.....	.....	.....	.....	.....
24 Hodge lever, thickness	1	1	1	.....	.....	.....	.....	.....
25 Hodge lever rod, diameter	1⅛	⅞	⅞	.....	.....	.....	.....	.....
26 Connecting rod, Hodge and floating lever, diameter	⅞	.....	.....	.....	.....	.....	.....	.....
27 Connecting rod, floating and truck lever, diameter	1⅝	.....	.....	.....	.....	.....	.....	.....
28 Extra truck lever, greatest width	7	.....	.....	.....	.....	.....	.....	.....
29 Extra truck lever, least width	3¾	.....	.....	.....	.....	.....	.....	.....
30 Extra truck lever, thickness	1¼	.....	.....	.....	.....	.....	.....	.....

*Six-wheel trucks. NOTE.—Schedules I, II, III, IV, V are designed for high speed brakes. Schedules VI, VII, VIII are designed for high pressure control and quick action triple valves. Lengths of levers are given in the diagrams and tables corresponding to the schedule number.

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.
PUBLISHED EVERY FRIDAY
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EDITORIAL ANNOUNCEMENTS.

CONTRIBUTIONS.—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

The arguments in favor of the three-position automatic signal, which are given in the report of Mr. Anthony's committee, printed on another page, are lucid; but, as intimated by the committee, the question whether it will supplant the prevailing two-arm signal is by no means settled. That the three-position automatic is not consistent with the three-position signal used for permissive signaling in the telegraph block system is, theoretically, almost conclusive against its use; except perhaps on a railroad, if such there were, where permissive signaling by means of the 45-degree position would never be required or allowed. The claim that the engineman's mental process of reading signals is easier with the old than with the new form also seems strong. Again, the advantage of having two lights on a post, each serving as a landmark for the other, is by no means unworthy of attention, though no thorough disciplinarian would think of excusing an engineman for overrunning a dead signal light because he did not have a second light to tell him where to find it. But against these theoretical disadvantages of the three-position automatic signal we have the concrete advantage of a saving in money, and that appeals to everybody—including some who do not take much interest in signal theories, although they have a vital interest in signal expenditures. One of the things that killed the theoretically attractive three-light semaphore on the Boston & Albany was the cost of the two additional lights. Add to this the saving in battery cost—which, as the normal-danger controversy has shown, appears to be worth consideration as long as half an ampere can be saved—and we find the three-position signal fortified in a way to give it a persistent vitality. Any one who thinks it will be killed off because it is thus far little used should ask himself why the upwardly inclined semaphore has not been killed off.

This discussion of the three-position signal is only one of a number of good reports to be read before the Railway Signaling Club at Detroit. One of the best is that on electric circuits for automatic signals, which was not ready for publication previous to the meeting. This will be found fuller in details than anything that has been published hitherto on this subject. The report on distant signals, published in this issue of the *Railroad Gazette*, should settle the question, as far as five good names can settle it, whether a mechanical signal can be successfully worked at a long distance. Men of experience have said that distances of 3,000 ft. and more caused them no inconvenience whatever; while others whose words should be of equal weight say that a 1,500-ft. wire line is difficult to manage. Some of the best signal engineers have said that 2,000 ft. is the limit of satisfactory service. The present committee does not name a definite distance, but as it is designing distant signaling for "the fastest train," and as everybody nowadays aims to give the "fastest train" at least 2,500 ft. to 3,000 ft. in which to stop, it is fair to conclude that the committee believes in the early and very general introduction of power-operated distant signals. There can be no doubt that the committee's position is sound. While it may be easy to show that under ideal conditions, with the best of care, and by the use of ingenious compensators a long wire line can be worked with satisfaction, the fact remains that in real life the "satisfaction," if there be any, is based, not on perfect service, but on what Mr. Anthony calls "optimism." The "optimist" pulls a blade down 15 degrees from horizontal and calls it a clear signal; or he throws the lever home and feels satisfied that the blade is horizontal—without taking pains to look at it carefully. Such practice makes careless enginemen, and wherever it prevails the report of this committee should be read and pondered.

The Fastest Time.

The results of the experiments with great speeds on the Military Railroad from Berlin to Zossen, 14.3 miles, in which a speed was reached greater than ever attained heretofore by any living creature on the face of the earth, are epoch making. An account of the means employed and the construction of the track on which it was attained is given in another column. Enough here to say that the experiments were made at the instance of the two great German electrical manufacturing companies, Siemens & Halske and the General Electric Co., and largely at their expense. Some months ago we noted that a steam locomotive had been designed intended to do what the electric cars have now done and that contracts for two engines of this design had been let. As nothing is said of these locomotives in connection with the recent trials, probably they are not yet completed.

It was intended in these experiments to ascertain not only the practicability of great speed, but, as exactly as possible, its cost; but naturally the figures for this cannot be given at once. Meanwhile some popular accounts of the trial of Oct. 6, when a maximum speed of 200.8 kilometers (124.8 miles) per hour was reached, give some interesting facts. The acting "motor-man" in this case was Dr. Reichel, an engineer of the Siemens & Halske Co., who wrote an account of the run for a Berlin weekly. The car left the Berlin station, Marienfelde, at 9.25 a. m. and reached Zossen, 14 miles distant, eight minutes later, having made an average speed from start to stop of 107 miles per hour. On starting, the current of each of the four motors was increased gradually to 350 amperes, making at the maximum about 2,600 h.p., and this to move a single car, weighing, however, 200,000 lbs. Within 1¼ miles a speed of 74 miles an hour was reached, which ⅝ mile further on had increased to 93 miles. A curve of 6,000 ft. radius was entered at a speed of about 108 miles an hour and at that speed it seemed as if the track was broken in front of the car. On leaving the curve an up grade of only 26 ft. per mile required an additional 300 h.p. to maintain the speed. At a station 4¼ miles from the start switches were passed without shock at a speed of 112 to 115 miles per hour. The switches had been prepared for the occasion.

At road crossings fragments of ballast as large as walnuts were blown into the air behind the train. The car being hung low, to one looking forward it seemed as if it swallowed the track literally, mile after mile. At one place there was a blow on a window near the motor-stand as loud as a blow of a fist on a table. It was caused by a bird *overtaken* in his flight. A speed of 124.8 miles per hour was first reached 8.7 miles from the starting point. Only a kilometer was run at this speed. The remainder of the run was made without current. On inspecting the car after the run its front end was found covered with flies, bees and other small insects, looking as if they had been crushed under the thumb-nail against the glass and iron.

No damage was done to car or rolling stock by the speed attained, but the most sanguine do not anticipate that a speed of more than about 100 miles an hour will be practicable and at that, with the most powerful brakes, the car cannot be stopped within much less than a mile.

The Board of Trade Inspectors.

The most intelligent and thorough investigation of train accidents is that of the inspecting officers of the British Board of Trade. These three or four men (at the head of whom is Lieutenant Colonel Yorke, who lately visited this country) are retired officers of the Royal Engineers. They not only possess peculiarly good qualifications but have enjoyed a high reputation for integrity. This last is a vital feature, for the reports which the inspectors make constitute the only authentic information of the causes of collisions and derailments on English railroads. All of the accident investigations, no matter how serious the case, are usually made and reported on by a single officer. He is practically both prosecutor and judge; though the only jury that confirms or disputes his judgment is the jury of the whole public. His decision is for the enlightenment of public opinion. Accidents causing death and injury are often made the subjects of lawsuits and decisions by the courts; but in England, as here, lawsuits do not usually instruct the public.

The facts gathered by the British inspectors and their opinions concerning them have been given frequently in the *Railroad Gazette*; not because we need to go to England to find accidents, or to learn what is the matter with men or materials when accidents occur; but mainly to set forth a method of inquiry which seems to have proved satisfactory; though incidentally many things in English practice brought out by these investigations have lessons for Americans. Things to imitate and things to avoid are plentiful.

Following our custom of former years, but giving less detail, we note below the salient points of the last Bluebook containing a summary. This book is not the regular report, containing tables and giving inspectors' reports in full, but is the secretary's resumé and review of the report for the calendar year 1902. The ratio of passengers killed in train accidents to the number of passenger journeys for 1902 was one in 198 millions killed, and one in 1,623,250 injured.* In the year preceding the ratio in the first column was infinity, as no passengers were killed. In each of five years since 1884 the number of passengers killed in train accidents was less than ten, but never, except in 1901, has the proportion been so small as in 1902. If the reader tires of finely spun mathematical ratios he can stick to the more concrete statements of the reports and still find plenty of material for astonishment at the remarkable record for safety attending the conduct of the 400 millions of train miles on these 22,000 miles of railroad. For example, the total number of persons of all classes killed in train accidents in 1902 was only 12 (six passengers, four employees and two other persons), and in 1901, when no passengers were killed, it was 11. Of the 37 accidents inquired into by the inspecting officers in 1902 only five were attended with fatal results, and one of these five was on a freight railroad and the persons killed were riding free in a caboose. Thirteen of the 37 were collisions within fixed signals at stations or sidings; five were due to obstructions on or defects in the track and three were on inclines.

The review classifies the investigations under the heads of (A) defects in or obstructions to permanent way; (B) failures of machinery and boiler explosions; (C) excessive speed entering stations; (D) rear collisions outside of fixed signals; (E) collisions at junctions; (F) collisions within fixed signals; (G) collisions between trains traveling in opposite directions; (H) collisions at level crossings of two railways; (I) trains wrongly turned into sidings; (J) accidents on inclines; (K) trains on fire; (L) miscellaneous.

Under the first head the principal trouble was with track repairmen who neglected to notify the signalman when they weakened the track. At Pengam Junction a foreman in the signal department made some repairs without properly fastening a loose switch point. The inspecting officer says that "accidents due to neglect of rules when repairing track had been rather numerous of late;" which seems to indicate that the inspectors take notice of some accidents which are not made the subject of published reports.

At West Croydon a whole passenger train was derailed and 45 passengers were injured because a track boss pulled six spikes, thus weakening the track, without putting out a flag. This man had been a ganger 23 years, and the inspecting officer is "astonished that a man of such experience should have committed such an error of judgment."

At Elephant and Castle station a passenger train was derailed by a cause almost exactly the same as the last. A chair and the keys of three other chairs were removed and no flagman was sent out.

"This neglect indicates a lack of discipline in the maintenance staff, the growth of which railway companies should do all in their power to summarily check."

The last case under this head was attributed.

*United States, 1902, one killed in 3,822,815; one injured in 189,524.

though not conclusively, to some weakness in the road (track). The ballast was not of the best, and the inspecting officer points out that all of the railways in that region—the South of England—"suffer from the difficulty of obtaining a sufficiency of good ballast." He further finds, however, that an order restricting speed to 15 miles an hour, which had been in existence for some months, had been practically disregarded. Had it been observed, even approximately, he was satisfied that the derailment would not have occurred. "The responsibility for the non-observance of this restriction rested largely upon the officers of the company."

Under class B there were two failures of axles, one causing the death of four passengers and the injury of 200. The axle was one of a lot bought from Cammell & Company two years ago, for which an exceptionally high price was paid on account of their superior quality. The flaw was undiscoverable and therefore we have from the inspector the following sapient observation: "No blame could therefore be attributed to any servants of the company in connection with this accident, but . . . it was very unsatisfactory that no method had yet been devised by means of which it could be ascertained whether an axle was structurally perfect throughout. Some method, by which flaws such as that which led to this accident could be detected, was much needed." If there had been a bell rope on this train, the passengers in the car which first failed would have stopped the train sooner and would have prevented part of the damage. The company is now fitting all of its passenger cars with communicating apparatus. The other axle failure resulted in a collision similar to the first mentioned. "It was a matter of regret that no method of testing had yet been devised by which the presence of an internal flaw in an axle could be detected."

Under class C an engineman who over-ran a stopping point is held to have "forgotten that the train was a heavier one than any of those which he had previously dealt with on that day."

Under class D we have an instance of those cases, occurring every few months in England, where a signalman admitted a train to a section in forgetfulness that there was already a light engine standing in the section. It appears that this engine was not going through to the next block station and that, therefore, the man at the out-going end was not advised of the presence of the engine. There is a rule that where an engine, in a situation like this, is detained on the main line, the fireman shall go back to the signal box, but it was found that it was not customary to carry out this rule. The inspector says that if the rule cannot be carried out light engines destined to an intermediate yard should not be admitted without first informing the signalman at the out-going end. The company has now put in detector bars, so that an engine waiting to enter the intermediate yard will hold the signals behind it locked.

Under class E the inspector criticizes the practice of allowing a train to foul a junction while another train is running up to the junction signals. In the case under review, some relaxation of this rule "appears to be unavoidable," but the company is censured for relaxing without first getting leave from the Board of Trade. He recommends that the junction signals should be arranged in groups, so that the signals of each line can be readily distinguished from those of other lines. Probably most American critics would remark that this recommendation had been apprehended and acted upon in this country for 15 years past. In this class there is another collision where a signalman forgot the presence of a light engine and the runner of the engine did not send his fireman back; but it is found that the rule requiring the fireman to go was somewhat indefinite. The inspector says it would be a great advantage if there were a telephone on the signal post for the benefit of the engineman; the practice of sending the fireman back "seems somewhat out of date."

In another rear collision the guard is held to have shown a "lack of judgment" in not sending back a flagman when he saw a train coming up behind him. The train was about 2,000 ft. away and was already in the same section. Passing over classes F and G, in which English practice is not much different from ours, we find in class H no accidents and in class I one, due to the mistake of a signalman who signaled a train past his cabin with a flag when a switch was wrong and the interlocking prevented him from clearing the signal. Being unable to clear the signal as he desired, he hastily assumed that the connections were out of order, and at once admitted the train without looking to see if his switch levers were in the right position. This is a reminder that published reports of a competent inspector would do good in this country, for this is a kind of error that occurs on American roads in connection with electric locking by track circuits. It is due to a mental infirmity which is so subtle that only by noting the lessons of others' experience is any individual likely to thoroughly guard himself against it.

Under class J an engineman and a brakeman of a coal train, who left some cars not properly protected on a very steep grade, causing a runaway, are held to have acted "with folly and negligence, showing themselves unfitted for their respective positions." This very steep grade was on a single-track railroad, used mostly for mineral traffic, and the remedy, according to the inspector, is to double the line, so as to make it practicable to put in catch points.

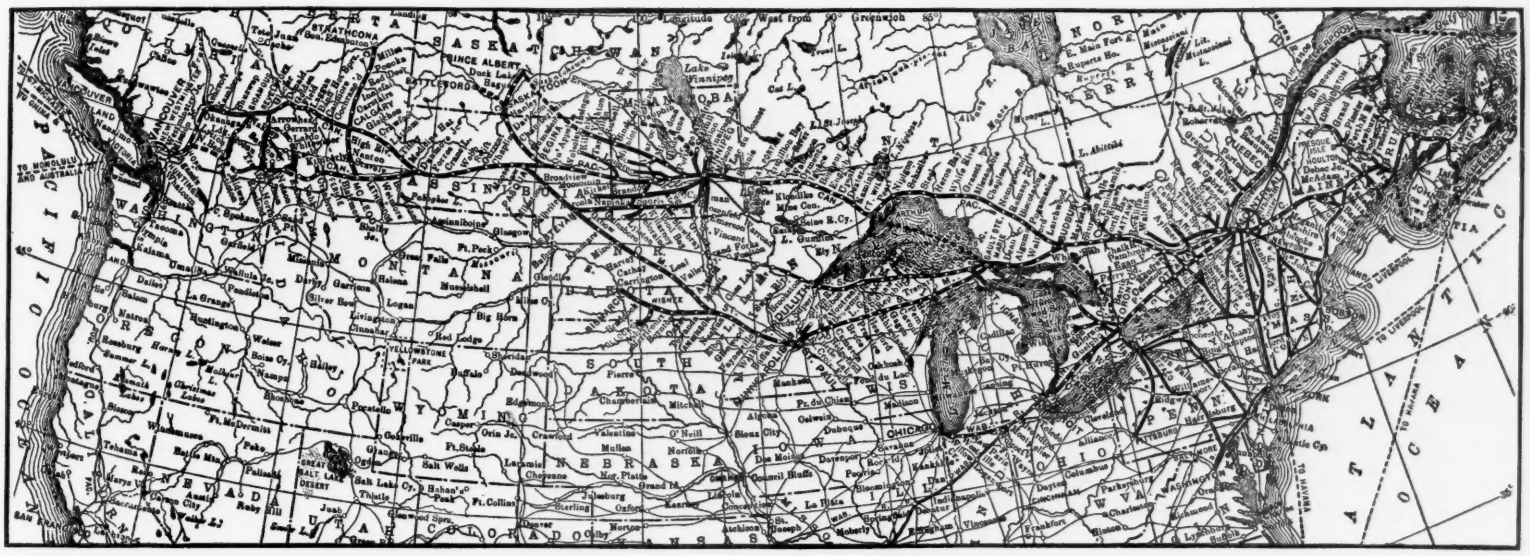
It will be noted that all of these inquiries, except those concerning axles, had to do with misconduct or neglect on the part of the men who managed the trains, by which term we mean not only conductors, enginemen, brakemen and firemen, but officers, signalmen and track repairers. The observation of the officer that instances of trackmen's carelessness have been "rather numerous of late" is an example of one of the most useful functions of the government inspector; the function of gathering information about those kinds of neglect which do not occur often on any one road, and the lessons of which will therefore be lost if men have to depend on their own observations, on their own road, for warnings. Another example under this head is the case of the engineman who forgot that he had an unusually heavy train. Hundreds of young brakemen, as well as firemen, could tell of cases where they would have avoided costly bumps if they could have had more vivid lessons on this point.

The account of the disregard of a speed-limit reads very much like a page from American experience. In England, as in America, many of the troubles of the railroads appear to come from wilful sinning against light, as in this case. The fact of the remarkably small record of deaths and injuries on English railroads still remains; but the lesson for us is that those accidents which do occur in England are due to the same kinds of lapses as those which are well known here. There is reason in the view that our cousins over there ought to feel greater mortification over collisions than should we; they have such shining examples of good service as warnings.

The suggestion for a telephone at each signal post, where needed, and the remark that sending the fireman to the signal cabin is out of date indicates that the inspectors are "up to date." They have been accused of over refinement in their strictures on some railroad practices; but there can be no objection to their demanding the highest standard in this matter. In the case where this observation occurs, however, the complete remedy would be a track circuit, affording automatic protection. The inspectors are slow in appreciating that safeguard. Where a block signalman forgets a train, the remedy to be suggested, if the track circuit arrangement had never been invented, would be the lock-and-block, or controlled manual. We should expect such a suggestion from the Board of Trade in a case like this. At all events, the signal makers will probably say that it is up to the inspector to recommend either one or the other.

Canadian Pacific.

The current report shows substantial increases in gross earnings, which amounted to $43,957,373, and although working expenses also increased very rapidly, amounting to $28,120,527, as against $23,417,141 last year, there still remains a large gain in net, which is $15,836,846 this year as against $14,085,912 last year. Interest on stocks held, etc., also increased somewhat, and there was a slight decrease in fixed charges; with the result that the surplus for the year's operation amounts to over $10,000,000, as against $7,709,914 in 1902. After deducting in each case $150,000 applied against cost of steamships, $9,921,461 was carried forward this year as surplus, a handsome increase. The cumulative prosperity of the company is well illustrated by the fact that the present



Canadian Pacific.

surplus for the year is considerably more than twice as great as the surplus five years ago (1898), and that, after satisfying the preferred stock and paying 5½ per cent. on the common, as against 4 per cent. in 1898, $3,973,961 was carried forward, as against $1,051,709 in that year.

Freight earnings for the current year amounted to $28,502,082, as against $24,199,428 last year. The greatest increase was in grain, of which nearly 64,000,000 bushels were carried, 10,000,000 bushels more than in 1902. With the rapid increases in freight traffic there has been a considerable reduction in the average receipts per ton mile, which amounted to 8 mills in 1895, 7.5 mills last year and 7.4 mills during the current year. The average train load shows a good increase and now amounts to 252 tons. Considering that this is nearly 200 tons less than the train load of the Great Northern, operating in territory in many respects similar, the traffic results obtained are rather surprising. It would seem to a casual observer that a considerable saving in the high cost of operation might some day be effected by attention paid to the important matter of train loading. Ton miles per mile of road, as indicating traffic density, amounted this year to 487,284, an increase of 18⅓ per cent. since 1902. Freight earnings per mile of road were $3,629, as against $3,097 last year.

Passenger earnings were $12,874,480, excluding steamer earnings, and the extent of the through passenger traffic is indicated by the fact that the average journey was over 114 miles. Passenger earnings per train mile show an increase over last year, and passenger earnings per mile of road were $1,690 as against $1,447, making the total earnings per mile of road $5,319 for the current year. Detailed traffic statistics appear for the first time in the report at hand, and give a much clearer insight

into the development and working of the property than could heretofore be obtained.

The chief physical changes in the property, since the last report, have been the acquisition of the Kingston & Pembroke Railroad extending from Renfrew on the main line to Kingston on Lake Ontario, 104 miles, and the leasing of the Calgary & Edmonton, which had previously been worked under an agreement with the owners, and of the Lindsay, Bobcaygeon & Pontypool Company's line from Burketon to Lindsay and Bobcaygeon. The former extends from Macleod to Edmonton in Alberta, 296 miles; the latter is about 40 miles long and is not yet completed.

New extensions aggregating about 150 miles have also been authorized. Under authority derived at the last annual meeting, 15 steamships were purchased from the Elder Dempster Company, constituting that company's Canadian Atlantic fleet. The purchase price was £1,417,500 sterling, and this amount has been temporarily advanced from the Canadian Pacific surplus earnings, pending the issue of 4 per cent. debenture stock.

Other new capital charges include $17,228,953 expended to the end of the fiscal year out of the proceeds of the sale of $19,500,000 common stock. About half of this, amounting to $8,715,697, was spent for new rolling stock, including 127 locomotives and 5,790 freight cars. The remainder provided for grade reduction and improvements of the line, new property, etc. Authority has also been asked to spend $5,000,000 this year on equipment in addition to all orders outstanding, which amount to approximately 5½ millions additional, and it is proposed to continue the policy of increasing the rolling stock equipment as fast as circumstances will permit, until the company is well ahead of its immediate requirements. Many of the new works chargeable to capital are being carried out on a more comprehensive scale than was originally contemplated, and the increase of nearly 50 per cent. within three years in the tonnage moved annually has made it imperative to provide facilities immediately, which, under ordinary conditions, might have been spread out over a number of years.

Statistics of operation follow:

	1903.	1902.
Freight earnings	$28,502,082	$24,199,428
Passenger earnings	11,001,974	9,359,522
Gross earnings	43,957,373	37,503,054
Conducting transportation	6,434,322	5,361,067
Maintenance of way	6,723,241	5,634,497
Motive power*	8,989,112	7,387,066
Maintenance of cars	2,487,977	1,868,045
Total expenses	28,120,527	23,417,141
Net earnings	15,836,846	14,085,912
Surplus carried forward from year's operation	9,921,461	7,559,914

*Including fuel, etc., as well as maintenance.

Chicago, Burlington & Quincy.

It is fair to say that the Burlington makes by far the most remarkable showing of any of the roads which have been reviewed this fall. The great increase in gross earnings, and the operating efficiency which reduced the ratio of expenses to earnings from 68 per cent. in 1901, to 64.7 per cent. in 1903, are results of unusual interest. At the time the Northern Pacific report was reviewed in these columns, some weeks ago, doubt was expressed as to the fulfilment of Mr. Hill's prophecy of 1902, that the three Northern Securities properties would this year earn 150 millions gross. As a matter of fact, the combined earnings of the Northern Pacific, the Great Northern and the Burlington amounted this year to $149,566,130, which is near enough Mr. Hill's prediction to make it an extremely good guess. If the interest on securities owned, and other income and interest be added to the receipts from operation, the joint earnings fall comfortably beyond the 150 point. The development of these three properties in gross earnings from operation is shown in the following table:

	1903.	1902.
Burlington	$62,638,378	$53,795,245
Northern Pacific	46,142,105	41,387,380
Great Northern	40,785,647	36,032,256
	$149,566,130	$131,214,881

The great increase in gross earnings on the Burlington, amounting to $8,843,133, has been accompanied by a very much smaller increase in operating expenses and taxes, amounting to $4,859,597, so that net earnings this year from operation were $22,095,906, an increase of almost four millions over the previous year. These gains were made on an average mileage worked of 8,324 miles, an increase of a little over 200 miles from 1902.

It is unfortunate that the form of the Burlington report cannot receive the same commendation that is given to the totals it contains. The affairs of the Chicago, Burlington & Quincy Railway Company, lessee, and the Chicago, Burlington & Quincy Railroad Company, lessor, are inextricably interwoven, and the management has brought upon its own head the severe criticism it has received from some sources because it published a report that could not be understood, and was consequently misinterpreted. The item of sundry accounts and bills receivable, for example, figures as $20,968,150 in the assets, as against $6,348,990 last year, an increase of over 14½ millions. An officer of the road, questioned by a critic, replied that this apparent discrepancy was caused by an interchanging of accounts between the lessor and lessee companies. But a report should, of course, explain itself without help from headquarters, particularly in the case of a trunk line with a large number of proprietary companies.

After the income on securities owned, etc., was added to net earnings, the total income of the Burlington for the year amounted to $22,442,446 and from this $9,116,338 was taken for interest, rentals, sinking funds, and other charges, leaving a balance of $13,326,108, as against $10,083,111 last year. The item of "other charges" here referred to, should certainly be explained in detail, since, amounting to $759,459 this year, it was not shown at all last year; but it receives no further notice in the report. From the income balance 7 per cent. dividends on the stock of the Chicago, Burlington & Quincy Railroad Company, not deposited as collateral for Northern Pacific-Great Northern joint C., B. & Q. collateral bonds were paid, aggregating $227,818, as against 6¾ per cent. last year. Interest for the year on the joint bonds, at 4 per cent., amounted to $8,606,752, leaving a surplus from operation of $4,491,538, as against $1,263,389.

A substantial improvement is recorded in train load, which figures at approximately 265 tons in 1903, as against 218 tons in 1902. It is rather singular that the Great Northern is the only one of the great northwestern lines, including the Canadian Pacific, to report a really large train load, although the Northern Pacific makes a good showing this year. Further reference to this matter, with a comparative table, will be found in the review of the Canadian Pacific, printed in another column. The Burlington's gains in traffic density have also been considerable during the past year, and, in connection with the gains in train load, furnish an excellent index of prosperity. Ton-miles per mile of road amounted this year to 592,405, as against 493,480, and passenger miles per mile of road, to 81,506, as compared with 74,008. A combination of the density figure with the train load figure shows that nearly 100,000 more tons of freight were carried a mile for each mile of road with 109 *less* freight trains per mile of road than in 1902. It is to be regretted that the report conveys little, if any, idea of the methods by which these excellent results were obtained, further than the statement of new cars and engines acquired, amounting, for lines owned and controlled, to 91 new engines and 1,200 new freight cars.

Statistics of operation follow:

	1903.	1902.
Freight earnings	$42,131,982	$35,455,955
Passenger earnings	13,886,344	12,660,406
Gross earnings	61,647,597	52,910,918
Conducting transportation	17,607,548	16,969,371
Main. of way and struc.	9,020,917	7,578,891
Main. of equipment	7,550,408	7,313,118
General expenses	3,563,567	1,410,100
Total expenses	37,742,439	33,271,480
Income from operation	22,157,774	18,024,866

Central of Georgia.

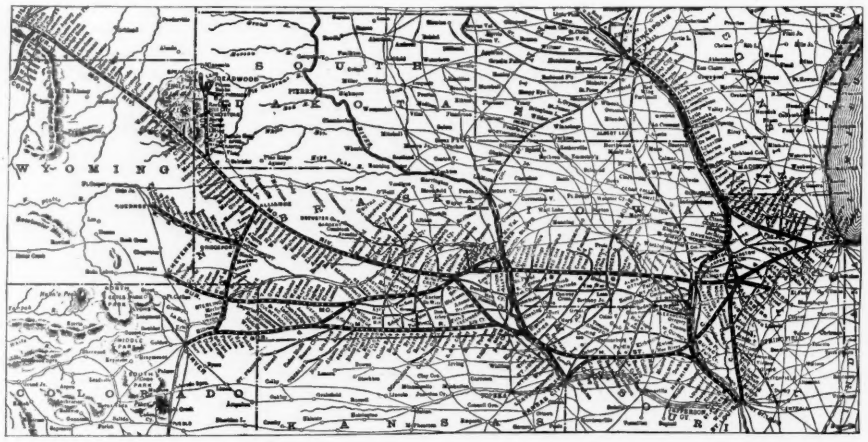
The fiscal year was a profitable one, as shown by the increased dividend on the first preference income bonds. The dividend declared is 5 per cent., against 3 per cent. the previous year. The dividend on these bonds is dependent on earnings, and in 1895 amounted to 1½ per cent.; in 1898 and 1899, 2 per cent.; in 1901, 5 per cent., and in 1902, it was reduced to 3 per cent. With a net surplus for the past year of $203,507, after a considerable charge for betterments, the company was able to declare a full 5 per cent. dividend ($200,000) on the bonds. Over an average of 1,845 miles operated, the same as last year, gross earnings were $9,164,471, an increase of $1,413,779, of which $980,275 was in freight earnings. Gross earnings per mile were $4,968, against $4,202 the previous year, and net earnings per mile were $1,269 against $1,203. The steady gain in net earnings per mile for the past two years shows that the company is now beginning to benefit from the various extensions built since 1898.

The percentage of operating expenses to gross earnings increased from 71.36 to 74.45, due chiefly to heavy expenditures for maintenance. Operating expenses increased $1,291,693, leaving an increase in net earnings of $122,086, and an unusually large amount was charged against maintenance for renewals and extensive repairs to bridges, buildings and rolling stock. The following table shows the chief figures of income account for the last two years:

	1903.	1902.	Increase.
Average miles operated	1,845	1,845	...
Gross earnings	$9,164,471	$7,750,692	$1,413,779
Operating expenses	6,822,732	5,531,039	1,291,693
Net earnings	2,341,738	2,219,652	122,086
Net income	203,507	122,941	80,566

TRADE CATALOGUES.

The American Diesel Engine Company, New York, is sending out a pamphlet on the Diesel engine, American type. The pamphlet explains what the Diesel engine is, what it will do, and its economy. The cost per hour for a 100-h.p. engine at full brake load is given at 36 cents per hour (9 gals. of fuel oil at 4 cents), or $1,080 per year of 3,000 hours. The cost for a gas engine of the same power is given at $3,240, and of a high-speed steam engine at $2,400. Comparing efficiencies, the highest obtainable in a steam engine is placed at 12 per cent. for a reheating compound or triple expansion; for the best gas engines, 19 per cent.; for a Diesel engine, 30 per cent. Tables of the saving in a Diesel engine over a slide-valve engine, over a gas engine and over electric power from central stations are given. The first Diesel engine, or motor, as the inventor called the small machine first produced, was 12 h.p. Now 40, 75, 120 and 225-h.p. engines are regularly built, and 400-h.p. units are in course of construction. A detailed and illustrated description of the engine is given; also a picture of the municipal lighting plant at Jewett City, Conn., containing two 75-h.p. Diesel engines driving two 50-k.w. alternating-current generators. The cost of power at full load for this plant is given at 7½ mills per kilowatt hour.



Chicago, Burlington & Quincy.

The American Blower Company, Detroit, Mich., has a number of new publications. Catalogue No. 155 deals with steel-plate fans. No. 118 is entitled "Mechanical Draft," and No. 145 shows interior and exterior views of various plants equipped with the "A.B.C." system of heating and ventilation. These catalogues contain, in addition to the usual descriptive matter, tables and other data of use to designers of heating and ventilating systems.

The Consolidated Car Heating Company, Albany, N. Y., has sent out catalogue No. 6 of apparatus and fittings for heating cars by steam. The catalogue contains 50 8-in. x 10½-in. pages, including an index. The illustrations are good and a number of double-page insets show the general arrangement of the piping, etc., for different types of cars.

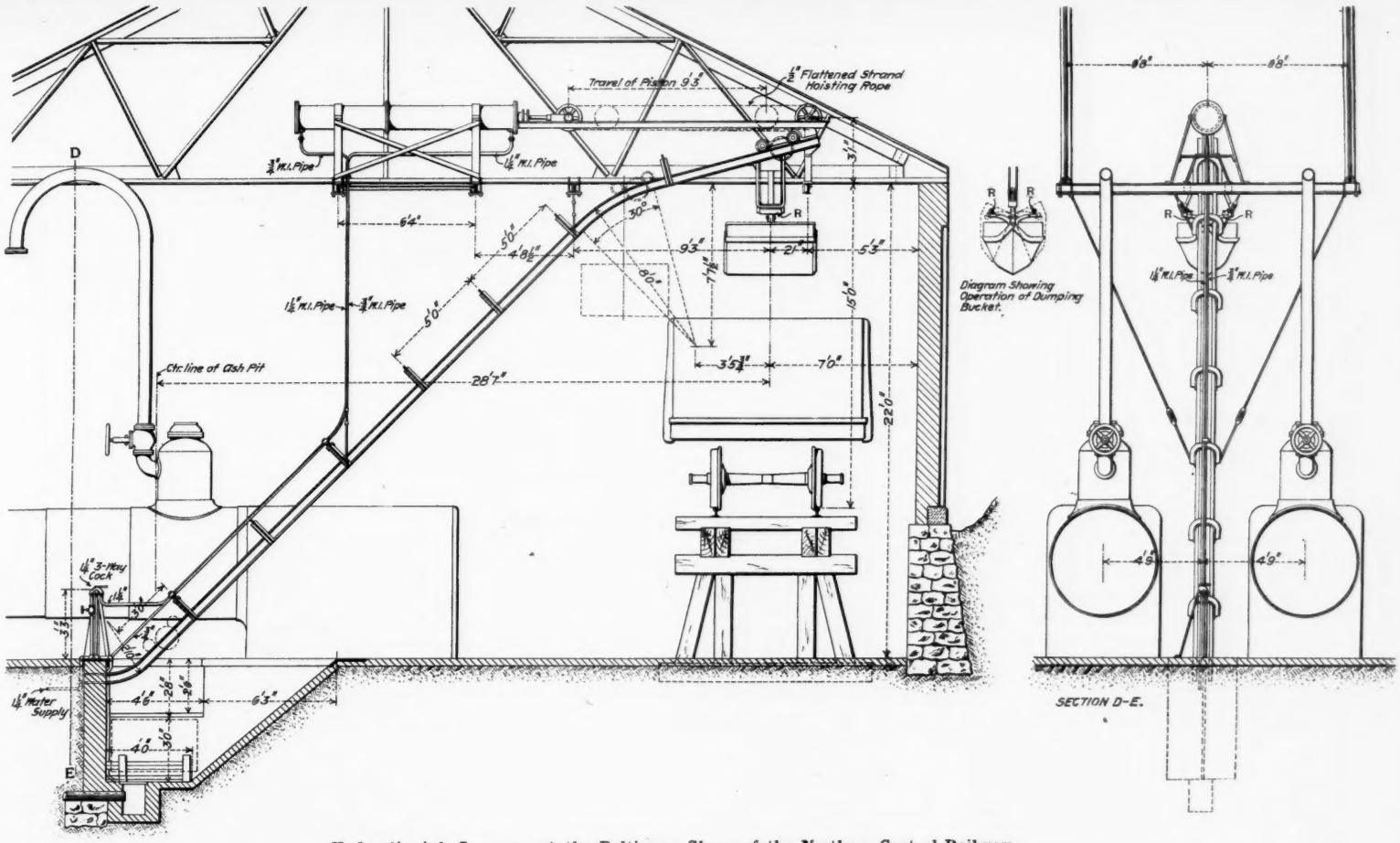
The Northern Metallic Packing Company, St. Paul, Minn., has issued a neat 16-page catalogue showing various applications of "Northern" metallic packing. The Curran chime whistle and whistle valve are also described.

Handling Ashes.

A novel and interesting device for handling ashes in the boiler house of the Baltimore shops of the Northern Central Railway (Pennsylvania) is shown in the accompanying drawings. The following description is furnished by Mr. A. P. Sharp, Chief Draftsman.

Handling ashes at steam generating plants, where the installation of modern coal and ash conveyors is not justified, is always a much-discussed question, and in designing such plants the same old query comes up "How are you going to get rid of your ashes?"

Herewith is submitted an improved design of a device which originated with the writer, and has been doing excellent service for a number of years. This device was originally intended to be operated by air, but was found on first trial not to work satisfactorily, so water was substituted and proved to be the right medium. The reason air would not do was that the angle of the rope and the guides for the trolley was so great that the trolley would stop when it reached the sharp curve of the guides, the air would compress, and then suddenly the trolley would shoot forward and bucket and all would crash against the stop at the end of travel. Hydraulic power was



Hydraulic Ash Conveyor at the Baltimore Shops of the Northern Central Railway.

therefore substituted, with water in both ends of the cylinder. Of course, where the head room permits and the runway can be made without such an abrupt curve, air, no doubt, could be used.

This arrangement is so designed that when the trolley has reached the end of its travel the piston has just enough travel left to open the bucket by continuing its pull on the rope, which in turn brings the arms of the clam-shell bucket in contact with the rollers marked R, causing the bucket to open. When the valve is changed to exhaust, the weight of the bucket and trolley is sufficient to bring the former down to its position in the pit, where the ashes are scraped into it as they accumulate, the top of the bucket being on a level with the bottom of the ash pits. The bucket holds about 14 cu. ft. of ashes, which weigh about 600 lbs.; the bucket weighs about 700 lbs., making the total 1,300 lbs.

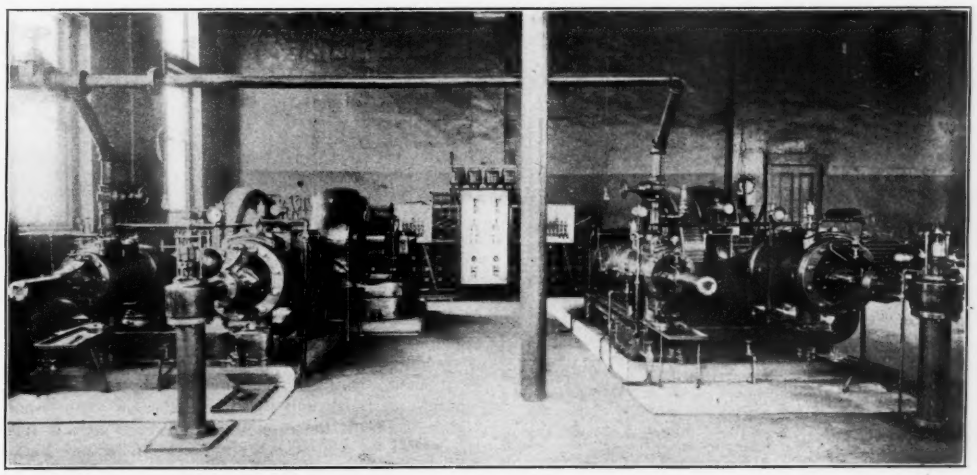
In the installation of this particular hoist, we used a 12-in. cylinder and tapped the high-pressure water line used for fire purposes. Where access is not had to a high-pressure water line, and air is convenient, a hydro-pneumatic arrangement can be used with good results.

Air Compressor Plant at Chicago (C. & N. W. Ry.).

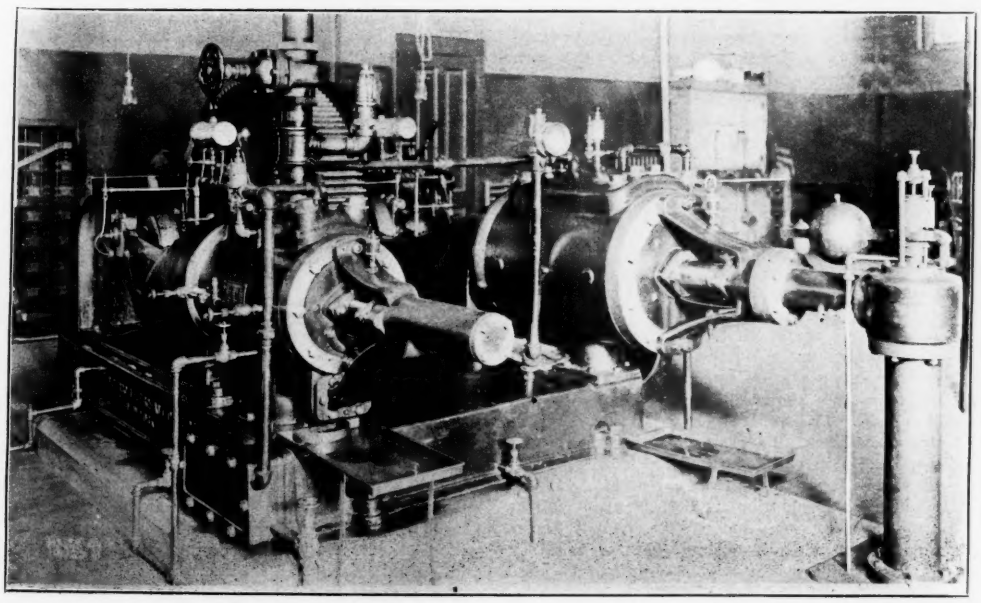
In 1893 the Chicago & North Western installed at its Chicago terminal a compressor plant for operating its electro-pneumatic switch and signal system. It included three Ingersoll-Sergeant 14 and 14¼ x 18 in. class "A" air compressors, each having a capacity of 365 cu. ft. of free air per minute. These were removed from the power station at Wells and Kinzie streets in June, 1901, and were set up farther out on the line.

The growth of business at the terminal demanded more power, and two direct connected electric motor driven class "J" Ingersoll-Sergeant compressors were installed at Wells and Kinzie streets. These are duplex compounds having low pressure air cylinders 18¼ in. in diameter with a 12 in. stroke, and high pressure air cylinders 12¼ in. in diameter with 12 in. stroke. Each compressor is driven by an 80 h.p. compound wound 220 volt direct current motor of the General Electric type; the motor being mounted on a sub-base bolted rigidly to the compressor sub-base and connected to the compressor by means of a large cut gear and raw-hide pinion.

The motor speed is 480 r.p.m. and the compressor speed is 135 r.p.m., thus giving each compressor a capacity of 470 cu. ft. of free air per minute which is compressed to 100 lbs. pressure. The motors are controlled by two starting and automatic releasing rheostats, the arrangements being such that the compressors can be run at six



Air Compressor Plant—Chicago & North Western Railway.



Air Compressor—Chicago & North Western Railway.

different speeds determined, of course, by the amount of resistance inserted in the motor circuit. Each motor is protected by circuit breakers which "blow out" when the amperage becomes too great for any cause.

The air inlet of each compressor is equipped with an automatic choking controller, which allows only enough air to be drawn into the compressor to satisfy the demand. As its operation is gradual the load is thrown on and off the motor gently, thereby eliminating any violent fluctuation in the motor loading. When there is no demand for air, there is none compressed and the motor is operated at the same speed, but under none but friction load.

The service is exacting, and as the demand for air has increased rapidly both compressors have been run almost continuously for 24 hours per day during the past year. After the air is compressed it is led to the aftercooler in order that any condensing moisture may be deposited. This aftercooler is rather unique and quite inexpensive. It consists of a series of panels, each panel having two large horizontal pipes into which are threaded a number of small pipes. The large pipes are capped at suitable places, so that the air must pass through the entire system. Connected to the large horizontal pipes are small receivers into which the moisture drains and can "blow off" at suitable times by opening small valves. From this aftercooler the air is led to openings where it is used.

The air is distributed by means of a 3-in. pipe line, which

extends four and a half miles north to Gross Park and three and a half miles west to California avenue. In addition to the switches and signals, this pipe line supplies air to the passenger yards at Erie street and Ashland avenue. The loss of pressure due to transmission is about 15 lbs. at Gross Park, the farthermost point. At various places in the pipe line drains are provided, so arranged that any moisture can be "blown-out" at intervals. At the California avenue freight yards are two 14 and 14¼ x 18 in. class "A" Ingersoll-Sergeant compressors. These serve to aid those located at Wells Street Station.

Primarily the compressed air was used for the switch and signal system, but now is also used for pumping water, blowing out locomotive flues, cleaning cars, cushions and rugs, jacking up cars in yards and operating small engines connected to dynamos which furnish current to large storage batteries. At the Wells street power house an air lift system provides 70 gallons of water per minute from a deep well and delivers it directly to the reservoir elevated about 25 ft. above the boiler room.

At points between Gross Park and California avenue are located signal towers, all of which contain storage batteries to furnish current for the switch and signal system. At some of these towers there is no direct electric current available for charging the batteries. Current is made available, however, by having small Westinghouse generators direct connected to Case engines which are driven by compressed air. The engines are about 3 h.p. capacity and are located at Wells, Ada and Sangamon streets and Ashland and Grand avenues.

We are indebted to Mr. A. J. Farrelly, of the Chicago & North Western, for the information contained in this description.

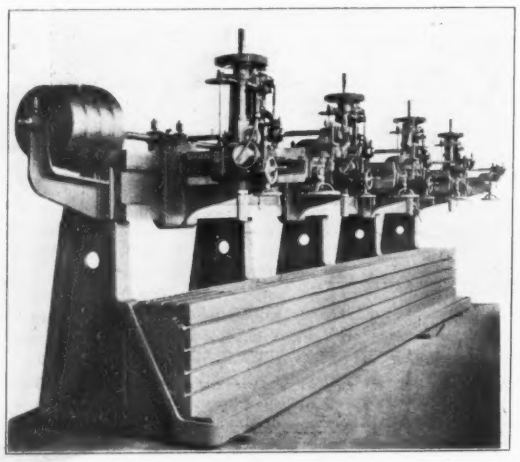
Bickford Locomotive Frame Drill.

The four-spindle drill shown in the accompanying engraving was designed and built by The Bickford Drill & Tool Co., Cincinnati, Ohio, from specifications submitted by the Locomotive & Machine Company, Montreal, Canada. The machine is to be used for drilling, reaming and tapping the sides and edges of locomotive frames up to 27 ft. 3 in. between holes.

The arms, one of which is made to rotate through an angle of 30 deg., are made in pipe section and are adjustable on the rail, either by hand or power. The spindles have eight changes of speed, ranging in geometrical progression from 49 to 120 r.p.m., and are provided with both hand and power feed, quick advance and return, safety stop, automatic trip, dial depth gage, and hand lever reverse. The back gears are located on the head, bringing the power direct to the work, and may be engaged, disengaged or thrown out of service while the machine is running, and the operator does not have to reach the shifter in order to stop the spindle.

The depth gage answers a double purpose. It enables the operator to read all depths from zero, which does away with the usual delays caused by scaling or calipering, and it supplies a convenient means for setting the automatic trip, the graduations showing exactly where each dog should be set in order to disengage the feed at the desired points.

The automatic trip operates at as many different points as there are depths to be drilled at one setting of the work; in addition it leaves the spindle free, to be advanced, raised and advanced, or traversed its full length, after any intermediate tripping, without disturbing the setting of the dogs; it also throws out the feed when the



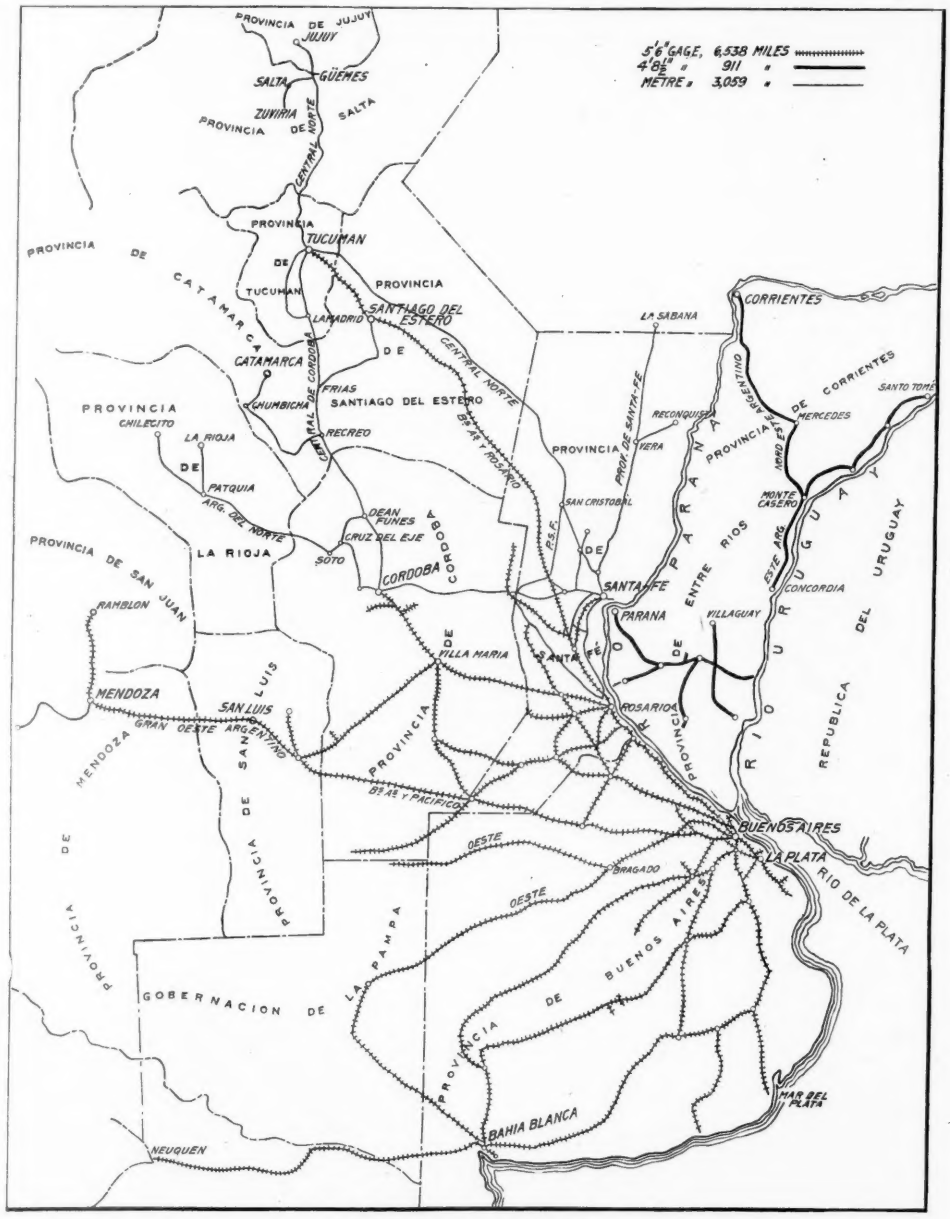
Bickford Locomotive Frame Drill.

spindle reaches its limit of movement. The feeding mechanism furnishes eight rates of feed, ranging in geometrical progressing from .007 in. to .064 in. per revolution of spindle, each of which is quickly available, eliminating any loss of time due to shifting a belt, or to operating under a feed of unnecessary fineness. An engraved plate attached to the head shows the operator how to obtain each of the feeds.

The tapping mechanisms are located on the heads, and are fitted with friction clutches operated by levers the handles of which extend around under the arms within convenient reach of the operator. The spindles are 2⅛ in. in diameter, have a vertical adjustment of 17 in., and operate over an area of 2 ft. 4 in. x 27 ft. 3 in. The table is 18 in. wide, 30 in. high, and 29 ft. long. The machine weighs 49,000 lbs. and is driven by a 5 in. high-speed double belt.

The Argentine Railroads.*

It is a very neat volume which is issued by the Ministry of Public Works of the Argentine Republic on the statistics of the railroads of that country, and does credit to the printing office of the National Penitentiary, which has done the work. The length of lines in the country is so moderate that in the 327 pages and 59 plates it is possible to include much detailed information, especially concerning traffic, which is rarely found even in reports of a single railroad company in this country or elsewhere, and which must be of great value to the commercial interests of the republic. Especially is this true of the tables of shipments of the 17 principal kinds of freight *from every station.*



The Argentina Railroads.

Argentina has not very close direct relations with this country, to which it exports chiefly wool and hides; but it deserves our attention particularly because it is, more than any other South American country, our competitor for the supply of Europe with wheat, Indian corn and meat. It has more nearly our climate, extending far enough north to produce sugar cane, but for the most part being a great plain suitable for grain-growing and grazing. Forty years ago it was little more than a great pasture, on which cattle were raised for their hides and tallow; but later sheep largely took the place of cattle, and still later, as transportation from the interior was cheapened, agriculture to some extent succeeded to grazing. For several years previous to 1890 the country grew like Kansas after the war. Railroads were subsidized and built and immigrants, attracted by free lands and other favors, came by the hundred thousand, especially from Italy. The catastrophe was something like that in this country in 1873; the national paper currency became worth about 30 cents on the dollar; and though production has increased since, the traces of this panic still remain. This report reduces all earnings, expenses, etc., to gold, on the basis of its average value per dollar of $2.317 in paper during 1901.

The Argentine Republic has an area of 1,114,000 square miles, and a population in 1901 of about 4,750,000. As the area exceeds that of the United States east of the Mississippi, it is evident there is room for more people there; but that it is at present not the most inviting place is indicated by the fact so many of the Italian immigrants stay but a short time. As recently as 1899 at least, the emigration was about half as great as the immigration, leaving a net gain from the latter of less than 50,000.

This great country at the close of 1901 had 10,508 miles of railroad, which gives a population of 453 per mile of railroad. The extreme north, which is chiefly a tropical wilderness; the extreme south, which is uninhabited Patagonia, and the extreme west, a semi-arid region at the foot of the Andes, are virtually without railroads. The west is reached by the Argentine part of the Transandine Railroad. During 1901 there was an increase of 228 miles, about half of it in one line, and the rest in short branches and extensions, the longest less than nine miles long.

Of the total length, 1,245 miles belong to the State. There are 3,059 miles of meter gage, 911 of 4 ft. 8½ in., and 6,538 of 5 ft. 6 in., which latter was introduced by the English in the first railroads built. There are but 246 miles of double track in the country, and 1,216 of sidings and switches. The lines were equipped with 1,297 locomotives, 1,396 passenger cars (with seats for 73,885), 1,034 baggage cars, and 35,503 freight cars. The average weight of the freight cars was 18,350 lbs., and their average capacity 29,670 lbs. An average of 26,990 miles service per locomotive is reported, but the train mileage was only 64 per cent. of this.

The market for supplies in Argentina may be indicated by the fact that in 1901 its railroads used 33,053 kilometric tons of rails, 10,755 of iron and steel sleepers, 769 switches and crossings, and 613,661 wooden crossties. Argentina produces a timber, "quebracho," said to be extraordinarily durable for ties; it has even been exported to Europe for that purpose.

The traffic of the Argentine railroads in 1901 was at the rate of 63 passengers and 236 tons of freight each way daily over the entire system, and of 97 passenger miles and 365 ton-miles per inhabitant of the republic. The gross earnings per mile were $619 from passengers and $2,924 from freight and $4,070 from all sources (the latter about half the average in this country). This was 4 per cent. more than in 1900 and 21 per cent. more than 1898. The working expenses were $2,212 per mile and 52.9 per cent. of the earnings, leaving net $1,858 per mile, which was 3⅜ per cent. on the capital invested, against 3¼ per cent. in 1900, and 3.58 per cent. in 1899.

The average rates received were 1.99 cents per passenger-mile and 1.59 cents per ton-mile. This passenger

*Republica Argentina. Estadistica de los Ferrocariles en Explotacion. Año 1901.

rate is about the same as in this country; the freight rate about twice as great. There are two classes of passengers; the second class is about 55 per cent. of the whole travel.

The chief freight shipments, in tons, were 3,243,000 of grain, 360,000 of flax-seed, 345,000 of hay and other forage, 12,200,000 sheep, 955,000 cattle, which, with other live stock weighed 1,236,000 tons; and 289,665 tons wool. Of the total weight 27⅓ per cent. was produce of the soil, 10⅔ live stock and animal products. Of manufactured goods sugar leads, with 805,928 tons, and wine amounts to 534,479 tons. The lumber and timber made up 793,520 tons; coal only 307,400 tons, and fire-wood 631,987. All mineral traffic is insignificant.

The grain tonnage is equivalent to about 110,000,000 bushels. Doubtless some of the shipments count twice, being received by one railroad from another. The wheat shipments were 53,846,000 bushels; the corn, 44,430,000. The wheat production of each of four of our States exceeds this, while there are many States which produce from four to seven times as much corn. The Argentine figures, however, are for shipments—not for production. Considering the small population of Argentina, probably more than two-thirds of its wheat is shipped; here (and doubtless there) only a small fraction of the corn goes to market. The shipments of oats and barley are insignificant, but more than 10,000,000 bushels of flax seed is moved. Evidently grain production is still much less important than grazing in the republic, and sheep and wool especially are important products.

The grain shipments are made chiefly on four of the 21 railroads, which four have in the aggregate 5,075 of the total 10,508 miles in the country. These four railroads carried 80 per cent. of all the wheat and 90 per cent. of all the corn shipped, and these quantities make a very respectable grain traffic for their mileage.

In spite of the financial crisis in 1891, the Argentine railroad system has continued to grow in extent, capital, traffic and earnings. The lines unfinished at the time of the crash—largely partly built—have been completed and added to. There has never since been such an increase as the 1,828 miles opened during 1891. Indeed, in the six following years only 1,436 miles were built, and 1,337 in the four years ending with 1901, but this is an increase of 36 per cent. in 10 years; which, judging from the returns, has been fast enough. The number of passengers, meanwhile, has increased 82 per cent., the tons of freight 203 per cent., the gross earnings 102 per cent. (gold), the working expenses 60 per cent., the net earnings 190 per cent. How this latter can be without having made the railroads very profitable is explained by the fact that the net earnings were only 1¾ per cent. on the capital in 1891. This capital has increased 43 per cent. meanwhile. While the net earnings on the average were 3⅔ per cent. on the capital in 1901, two small lines were worked at a loss, and three of the larger companies and one small one earned more than 5 per cent.

Notwithstanding the moderate returns, we see thus that Argentina has succeeded in increasing materially its railroad system and developing its resources through them since the catastrophe of 1891.

A Comparison of Steel and Copper Fire-box Stays.

Some interesting figures of the comparative results in service of copper and steel staybolts for locomotive fireboxes are given by Mr. F. H. Trevithick in discussing Mr. F. W. Webb's paper on locomotive fire-box stays read before the Institution of Civil Engineers of Great Britain April 22, 1902. These figures, which were from the Egyptian State Railways, were in tabular form as follows:

No.	Maker.	Date of construction.	Total mileage to end of March, 1902.	Total stays replaced.	Average mileage per stay replaced.
		Goods.			
20	Baldwin	1898	2,068,145	1*	2,068,145
10	Neilson	1898	789,589	201	3,928
15	Franco-Belge	1898	1,311,189	1,849	709
15	Marcinelle 1898-99		1,088,603	2,343	464
10	La Meuse.....	1899	625,380	3,111	201
10	Haine St. Pierre..	1899	611,416	3,405	179
		Passenger.			
12	Neilson	1889	4,185,842	2,831	1,482
52	Franco-Belge 1890-95		14,074,623	4,592	3,065

*This solitary stay had to be replaced on account of defective thread in the plate, not for any defect in itself.

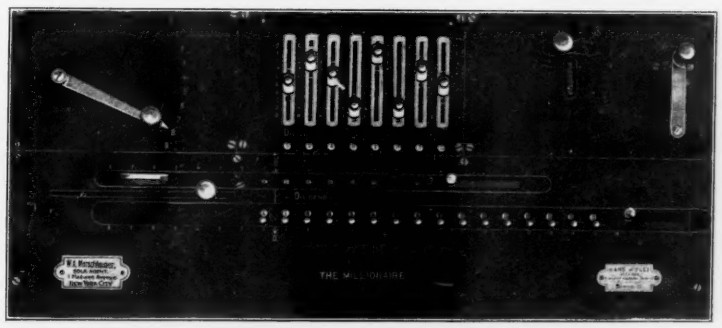
The boiler-pressure in the instances selected, with the exception of the 20 Baldwin engines, was 140 lbs. per sq. in. The Baldwin engines were worked at 160 lbs. per sq. in. Of the above 144 engines, the 64 passenger and 60 of the goods engines were of English type and design, though built by different makers (22 being built by Neilson, 67 by Franco-Belge and 35 by three other Belgian firms); the remaining 20 were American engines built by the Baldwin Company to their own design. The passenger engines, so far as the eye could judge, were identical in design. Fifteen goods engines were not only identical in design, but their boilers were also identical with those of the passenger engines, while 45 goods engines were identical one with the other, and their boilers were also identical with those of the passenger and the 15 goods engines, with the exception that the outside fire-box shell was raised above the boiler barrel. The American boilers differed from the rest, especially as regarded the metal used, the plates and stays being made of mild steel in lieu of copper. The passenger engines and 50 of the goods engines had been stationed at the same depot (Bulac, Cairo,) and had been used respectively on similar work. Of the remaining goods engines, 10 had been stabled at Gabbary, Alexandria, and 20 (Americans) at Tantah. As would be seen from the foregoing table, the American engines had totalled 2,068,145 miles with one replaced stay, while the remaining goods engines had totalled 4,426,187 miles with 10,909 stays replaced, or one stay per 405 miles; the passenger engines had totalled 18,260,465 miles with 7,423 stays replaced, or one stay per 2,459 miles.

A study of these records brought to light facts which merited the highest consideration, in order to find satisfactory reasons for results so widely different between the British and the American boiler, each typical in design and manufacture of the country of its origin. Very varied results in boilers constructed to the same drawings, conditions and inspection, but by different manufacturers, had also been experienced. The excellent result of the Baldwin boiler must, it was thought, be attributed to the fact that as only one metal was used in constructing its various parts, the strains from differing coefficients of expansion and contraction were obviated. Such remarkable results would doubtless be a surprise to many, and would lead engineers to consider seriously the advisability of the use of one metal only in the construction of boilers. The cause of so varied a life of fire-box stays in boilers in similar design, construction and inspection, and which apparently had been worked and attended to under similar conditions, must be sought for in the quality of the metal used. It could not be accounted for in any other way.

Of the 350 miles of the French Soudan State Railway from the Senegal river to the proposed terminus at Kouli-koro, on the Niger river, the first section, from Kayes to Faugala, 108 miles, is finished and work had progressed to the 258th mile in 1902; it is hoped that a length of 311 miles will be finished by the end of 1903, and the terminus reached in 1904, in which event the road will be opened for traffic in 1905. The company building this road has encountered many physical disadvantages in its railroad schemes in the French West African possessions, the region to be opened up being destitute of navigable rivers and so far from the sea that the work seems almost impracticable. The company has already been occupied at this work nearly a quarter of a century, at a total cost in the neighborhood of $16,000,000. All material has to be carried over the sand bar at the estuary of the Senegal river.

A New Calculating Machine.

A machine designed to work out every possible simple or compound calculation that can be performed by any of the four fundamental processes of arithmetic, has been patented by Otto Steiger, of Switzerland. The principal advantage claimed for the machine is the simplicity and rapidity with which the operations can be performed. An engraving from a photograph of the face of the machine is shown.



The "Millionaire" Calculating Machine.

The crank in the upper right-hand corner is the operating handle, one complete turn of which must be given for each figure in the multiplier or quotient. Next to the crank is the "regulator," which is placed at one of the four letters, depending on the process to be used. The eight vertical slots with figures at the sides are the "markers," by which the amounts to be added, the subtrahend, the multiplicand or the divisor are placed. The factor given by the markers is repeated in a straight line on the dials immediately below. The lever at the left is the "multiplication lever," by which a multiplier, or quotient, is set out one number at a time, the figures showing in the middle horizontal row of dials. The operating crank is turned once for each figure. For addition and subtraction the multiplication lever is placed at the figure 1. The lower row of dials records amounts, products and remainders; also subtrahends and dividends are set up in this row at the beginning of these operations, by turning the small knobs directly under the dials. Provision is made for placing decimal studs in the dial rows. The large knob at the left, over the slot between the middle and lower rows of dials, is the carriage shifter, and the two knobs which appear at the right of the two lower dial rows are the effacers.

The rapidity with which the machine will work is indicated by the claim that an example such as 23,769,814 × 18,769,423 = 446,145,693,597,322, can be performed in six or seven seconds. Any mistake made by the operator is at once indicated by a signal bell, and can be easily rectified.

The machine, which is called the "Millionaire," could be used to advantage in railroad and other large offices where there are numerous calculations. W. A. Morschhauser, 1 Madison avenue, New York, is the agent for the United States and Canada.

Butting Collision on an Irish Single-Track Railroad.

That our British friends are not quite clear of collisions on single tracks is shown by a report just issued by the Board of Trade. This has reference to a butting collision that occurred on August 2d at Ballymote, on the Midland Great Western of Ireland. While the collision occurred primarily from an engineman overrunning his signals, yet there was bad block working and defective regulations.

The station is laid out as here shown.

The line is worked by the electrical staff. Ballymote is a meeting place, but it is not laid out to conform with the Board of Trade regulations. There is only one platform, and so, when a second passenger train arrives, it, or the first train, has to be run on to the side track.

On the day of the collision the towerman at Ballymote was offered a down train from Dublin at 11.32 p. m. and an up train from Sligo at 11.35 p. m. He accepted both trains and left the switches at each end of the station lying for the main line. Both up and down home and distant signals were, however, kept at danger. The up train arrived first, and was admitted into the station. The towerman then attempted to shift switch No. 4 to turn the down train on to the side track, but the engineman of the down train failed to stop at the home signal, and the train was already on No. 4 when the towerman attempted to move it, and a collision between the two trains ensued. The speed of the down train at the time of the collision was very small, so the injuries and damage were but slight.

The Board of Trade Inspector blames the runner of the down train for having passed the down home signal at danger and the towerman for not shifting the switch at the Dublin end of the station so as to lie for the side track before accepting the down train. But there are some other points:

(1) Ballymote station is not a suitable passing place. The side track is not provided with any platform nor signals for entering it, and as the facing point lock for the facing points in the main line stands normally bolted, the bolt has to be withdrawn and is compelled by the interlocking to remain out, so that the switches cannot be bolted when a train enters the side track.

(2) The simultaneous acceptance by the towerman at Ballymote of up and down trains with the points at each end of the station set for the main line was a most dangerous proceeding. The inspector says, however, that it is difficult to blame the towerman for his action in the matter, as it had been customary for this to be done at the station, and, "though it seems almost incredible, the company was unable to produce any rules as to block working on single lines." A towerman therefore at a staff station on a single line has absolutely no rules to guide him as to the conditions under which he is justified in accepting trains. The company has been considering the advisability of adopting what are known as the English Clearing House Rules, and showed a printed proof of proposed rules in which were included rules for block working on single lines. "The existing state of affairs is very unsatisfactory and very dangerous, and great responsibility will rest on the company if they do not take early steps to rectify it."

(3) The hours worked by some of the locomotive men are excessive. The driver who was in charge of the second engine of the down train had come on duty at 5.30 a. m. on the day of the accident to work till 1.30 a. m. on the following day with five hours off duty during the day. He was therefore on duty for 20 hours with only five hours off his engine. His fireman was working the same hours. The Inspector says that such hours as these are absolutely unreasonable for men performing the responsible duties of driver and fireman of an engine, and that it is not surprising under the circumstances that at midnight these men failed to keep a careful look out. The working of such long hours as these should be absolutely prohibited.

TECHNICAL.

Manufacturing and Business.

Motley, Green & Co. (formerly Thornton N. Motley Co.) have removed their offices from 12 John street to 66-68 Broad street, New York.

The National Steel Foundry Company, New Haven, Conn., is putting up a building 165 ft. x 410 ft., at a cost of about $80,000.

The Weil Manufacturing Company, Chicago, has been incorporated with a capital stock of $100,000, to make steel and iron castings, by Arthur Weil and others.

The Automatic Car Ventilator Company of Portland,

Me., has been incorporated with a capital of $200,000 in Maine; W. B. Baldwin and W. A. Castner, incorporators.

The Sterlingworth Railway Supply Company has closed its Chicago agency and all business will be transacted at the general offices in the North American Building, Philadelphia.

The Trussed Concrete Steel Company, of Detroit, Mich., has been incorporated to build reinforced concrete work by the Kahn system. Julius Kahn is President, and Ralph M. Dyer, Secretary.

The referee, Wm. H. Hotchkiss, in the bankruptcy proceedings against the New York Car Wheel Works, Buffalo, N. Y., asked bids up to Nov. 5 for the property, good will and all the assets of the company.

The Lunkenheimer Company, Cincinnati, Ohio, has opened a branch office in Paris, France, 24 Boulevard Voltaire, and will carry a complete line of brass and iron steam specialties, engineering appliances, etc.

The National Cellular Steel Company, of New York, has been incorporated in New York, with a capital of $250,000, to make patented and unpatented devices in connection with construction of railroad cars, wheels, etc.

Charles T. Bishop, formerly with Ladenburg, Thalmann & Co., New York, and late Paymaster in the United States Naval Service, has been appointed Auditor of the H. W. Johns-Manville Co., 100 William street, New York.

A company, with a capital of $50,000, has been organized at Lexington, Va., to make an automatic air-brake invented by J. P. Birmingham. The officers are W. G. Matthews, of Glasgow, Va., President; Robert Catlett, Lexington, Secretary.

The Dominion Government has authorized the Locomotive & Machinery Company of Montreal to increase its capital from $1,000,000 to $3,000,000. It is the intention of the company to rush work on the extension of its shops at Longue Pointe.

The Van Buren, Heck & Marvin Company, of Findlay, Ohio, maker of ditch making machinery, has decided to enlarge its shops at Findlay. Land has been bought, on which will be built a machine shop 150 ft. x 200 ft., a foundry 60 ft. x 80 ft., and an office building.

For pumping sewage at the St. Louis Exposition Henry R. Worthington has an order for four 12-in., vertical, centrifugal sewage pumps, each having a capacity of 3,000 gallons a minute and capable of operating against a head of 60 ft. These pumps will be driven by Westinghouse vertical-shaft induction motors.

The statement of the Pressed Steel Car Company for the nine months ending Sept. 30, and for the third quarter, shows net earnings of $2,644,167 for the nine months, a decrease of $660,571, as compared with the corresponding period of last year. The falling off was due to the poor business during the three months ending Sept. 30. In this period net earnings were more than 50 per cent. below what they were in the corresponding period of last year, and only $2,000 in excess of earnings in the corresponding quarter of 1901. In the year ending Dec. 31, 1902, a surplus of $2,903,114 was reported. It is now about $4,500,000. The company in its last fiscal year paid 7 per cent. on the preferred stock and the regular dividend of 4 per cent. on the common. The quarterly dividend of 1¾ per cent. has been declared on the preferred stock, payable Nov. 25, and the usual quarterly dividend of 1 per cent. on the common stock. Also the fourth installment of the extra dividend of 1 per cent. on the common stock is to be paid at the same time as the regular common dividend Nov. 30.

Iron and Steel.

The Lackawanna Steel Company of Buffalo, press reports state, has a contract for 12,000 tons of rails for the Atchison, Topeka & Santa Fe.

Press reports state that the Tennessee Coal & Iron Company has received a contract from the Louisville & Nashville to supply about 10,000 tons of rails, delivery to commence Jan. 1.

The American Standard Steel Fitting Company of Milwaukee has been incorporated with a capital of $100,000, to press and weld metals, with Joseph Schurek, Daniel Homer and others as incorporators.

The Iowa Malleable Iron Company, of Fairfield, is building a foundry 106 ft. x 142 ft.; a cleaning room, carpenter and pattern shop, 40 ft. x 421 ft.; annealing and shipping room, 70 ft. x 118 ft. The company is in the market for new machinery.

Interlocking.

A large interlocking plant is to be built at the crossing of the Gulf, Colorado & Santa Fe and the San Antonio & Aransas Pass roads at Cameron, Tex.

The Mexican Central is putting in interlocking at its crossing with the Mexican International at Sauceda.

Tests of Barker Mail Cranes.

The C., M. & St. P. made a special test of the Barker mail crane at Milwaukee, Wis., on Oct. 3. The crane was set up on the main line of the La Crosse division near West Milwaukee. A special train was provided, having a coach and mail car. The first test was to drag by the crane and pull the pouch off at a speed not to exceed three or four miles an hour. This is the severest test for a crane. The release on the arms let go evenly. Other tests were made at higher speeds, from 10 to 60 miles an hour, all with satisfactory results. A representative of the United States railroad mail service witnessed the tests. The Missouri Pacific, Union Pacific, M., K. & T., C. & N. W. and Illinois Central are also experimenting with the crane. One has been in service on the C. & N. W. for 15 months. At Vergennes, Ill., on the Illinois Central, a Barker crane is used at the bottom of a long grade where the speeds are very high.

Locomotive Testing at the St. Louis Exposition.

At a meeting of the Advisory Committee of the Pennsylvania Railroad on locomotive testing at the St. Louis Exposition in 1904, held in Pittsburg, October 28, the question of the characteristics of the locomotives to be tested and the extent and character of the formal publications of the tests to be given out was discussed. The action of the committee will be recorded in the first bulletin, to be issued soon. Messrs. Casanave, Gibbs, Vogt and Nelson, representing the railroad company, and Messrs. Herr, Sague, Quereau, W. A. Smith and Goss, representing the Advisory Committee, were present at the meeting.

Steam Motor Cars on the Great Western.

On October 14, the Great Western of England put in service the first of a number of steam motor passenger cars which are to be run between Chalford and Stonehouse. These cars are 57 ft. long, 8 ft. 6¾ in. wide, and 8 ft. 2 in. high, inside measurement. The total wheel base is 45 ft. 6 in. and that of the motor truck is 8 ft. The driving wheels are 44 in. in diameter and the cylinders are 12 in. x 16 in. They drive the trailing pair of wheels, which are coupled to the leading pair. Walschaert valve gear and balanced slide valves are used. Steam is supplied by a vertical boiler with cone top, 4 ft. 6 in. in diameter, 9 ft. 6 in. high, and containing 477 1⅛-in. tubes. The heating surface is 669.92 sq. ft., the grate area is 11.48 sq. ft., and the working steam pressure, 180 lbs. A water tank holding 450 gallons is carried under the car. The tractive effort is 8,483 lbs. based on 90 per cent. of the boiler pressure. The car has accommodations for 52 passengers and a small amount of baggage. The seats are arranged in the same way as on the elevated cars in this country, cross seats holding 16 persons being built in the center of the car and the remainder arranged longitudinally along the sides. The cars are lighted with gas and are equipped with hand and vacuum brakes which can be operated from either end.

Foundry Costs; Their Analysis and Reduction.

At the meeting of the Engineers' Club of Philadelphia held Oct. 17, Mr. Henry Hess read a paper on the above subject. He stated that in order to manage a foundry economically it is necessary to know accurately the various elements of expenditure and having these, to analyze properly their relation to one another and to the product. The manager is then in a position at once to check any rising tendency of the cost or to bring about a reduction if the analysis shows this to be possible. In illustrating a method of analysis the elements of cost were divided into a few main items (it being understood that for actual work a subdivision more in detail must be used) as follows: General Expense, Fixed Salaries, Power, Miscellaneous Materials, Labor, Pig and other Charging Metal, Smelting Material, Light, and Recovered Material. Under each of these heads Mr. Hess had prepared a diagram showing the ideal cost per 200 lbs. of castings for an output of from 25 to 125 tons of castings per week. The total ideal cost of production would be represented by a combination curve based on the elements of the whole series of curves. The figures used for the various curves were merely illustrative and no attempt was made to provide a record of actual or proper cost.

Experience must be relied upon gradually to bring about correct values for each item. The cost per pound rises when the product is small and decreases with an increasing output, and by means of the diagrams it was shown how to determine whether this increase or decrease in cost followed the ideal curve. In case a difference was found between the actual and ideal cost of production an analysis would be expected to show under one or more of the various heads an excess cost, and if this could be reduced to the ideal cost the record for the following week would probably show the actual and ideal costs approaching each other. Mr. Hess stated in discussion that he had found by this method, in one case, that a decreasing output had been cast so economically as to actually reduce the cost of production.

THE SCRAP HEAP.

Notes.

The Vandalia Line has opened schools of instruction for its trainmen at Indianapolis, Brazil, Effingham, St. Louis and Terre Haute. "Lectures" are to be given at each of the schools in succession, by Mr. James M. Lindley.

In an opinion in the suit of the Union Tank Line Company of New Jersey against the Board of Review of Chicago, the Supreme Court of Illinois has lately held that cars in transportation other than those of railroad companies can be assessed only in the State in which the company's headquarters are located.

Tennessee newspapers report that, acting on a request or notice from the State Railroad Commission, which had been issued at the instance of the Governor of the State, the Pullman Company and the Louisville & Nashville Railroad have issued orders prohibiting negroes from riding in sleeping cars and dining cars occupied by white passengers.

Mr. Midgley's essays on car service, which are still kept up, have drawn out a remonstrance from a private car owner, which is in the shape of a pamphlet signed by Alonzo C. Mather, of Chicago, inventor of the Mather stock car for feeding and watering animals without unloading them. Mr. Mather says that the outside companies, owning cars for special kinds of service, are a necessity; it is an advantage to the railroad companies to have large supplies of cars kept at railroad centers. He says that as these cars have to stand idle waiting for loads a large portion of the time, the rates which the railroads pay for them are not so exorbitant as they seem. The reduction in the mileage rate from 7½ mills a mile to 6 mills, which was made about 10 years ago, brought ruin to two large car companies, says Mr. Mather, and practically killed off many smaller ones. With the increased cost of material and labor, the rate for private cars, he says, should be restored to ¾ of a cent a mile.

Dynamite Disaster at Crestline.

On the night of November 1 an explosion of dynamite in a freight car in the yard of the Pennsylvania at Crestline, Ohio, set fire to a great number of loaded freight cars and broke windows in scores of hundreds of houses near by. It is said that the loss will amount to hundreds of thousands of dollars.

Fires.

The repair shops in Allegheny of the Pittsburg & Western were damaged by fire Oct. 23, loss about $40,000. Subsequent fires caused an additional loss of about $10,000. The Johnson Forge Company's buildings at South Wilmington, Del., were destroyed by fire Oct. 28, with a loss of about $100,000. The grain elevator and storehouse of the Baltimore & Ohio in Philadelphia were damaged by fire Oct. 30, loss about $65,000.

Sixteen Passengers Killed at Indianapolis.

On Saturday, October 31, about 11 a.m., a collision between a passenger train and a freight on the Cleveland, Cincinnati, Chicago & St. Louis, in Indianapolis, a short distance west of the station, resulted in the death or fatal injury of 16 passengers and the injury of more than 30 others. The passenger train was loaded with football players and their friends, mostly from Lafayette, who were going to attend a game at Indianapolis. The fact that nearly every one of the victims of the accident had numerous friends on the train made the scenes following the disaster unusually heartrending. The passenger train is described in the press despatches as a special and the persons killed were all in a passenger car which was next to the engine. This car was completely crushed, the second was telescoped and thrown down a bank, and the third was thrown across the track. Six cars of coal in the freight train were wrecked. The reports indicate that the presence of the freight train on the main track in the face of the passenger train was due to conflicting telegraphic orders.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular mettings of railroad associations and engineering societies see advertising page xvi.)

Western Society of Engineers.

On Oct. 29 about 70 members of the Western Society of Engineers left Chicago on a special train for the purpose of seeing the progress of the work on the Mississippi River bridge at Thebes, Ill., and inspecting the Ayer & Lord Tie Company's plant at Carbondale, Ill. The Thebes bridge was described in the *Railroad Gazette* Jan. 9, 1903, and the tie plant at Carbondale was described Sept. 11, 1903. Pier No. 1 of the Thebes bridge is completed. The foundation of pier No. 2 is completed and the masonry is being laid. The caisson work on pier No. 3 is in progress. The caisson for pier No. 4 is being built and will soon be floated into position. The foundation of pier No. 5 is finished. The east approach, consisting of five 65-ft. arches containing about 15,000 cu. yds. of concrete, is practically finished and the foundations for the west approaches are now being built. Heavy grading on both sides of the river has been commenced. The substructure is expected to be finished by the summer of 1904.

The party returned Oct. 31 by way of the Illinois Central and stopped to see the bridge over Big Muddy Creek which consists of three 140-ft. concrete spans.

PERSONAL.

—Mr. F. M. Nourse, recently Auditor of the Louisville & Atlantic, died Oct. 23, aged 64 years.

—Mr. Edward B. S. Sanborn, Clerk of the New Hampshire State Railroad Commission, died Nov. 3, at his home in Franklin Falls, N. H.

—Prof. W. F. Durand, of Sibley College, Cornell University, has been appointed Acting Director of the College, to succeed the late R. H. Thurston.

—Mr. Charles A. Goodnow has been appointed General Manager of the Chicago & Alton as announced in another column. His resignation as General Manager of the Chicago, Rock Island & Pacific was only recently noticed in these columns (pages 749 and 766). It is reported that the General Superintendent of the Alton, Mr. J. H. Barrett, has resigned, and that the duties of his office will be performed by the General Manager,

—Mr. John Hair, who on the first of this month was promoted to succeed Mr. Neuffer as Superintendent of Motive Power of the Baltimore & Ohio Southwestern, began his railroad service as an apprentice on the Ohio & Mississippi in 1877, and remained with this company until the spring of 1888, when he took a position on the Cleveland, Cincinnati, Chicago & St. Louis; but in a short time he returned to the Ohio & Mississippi as foreman of shops at Pana, Ill. In 1895 he was transferred to Washington, Ind., as General Foreman, and two years later became Master Mechanic at Chillicothe, Ohio, the Ohio & Mississippi having been in the meantime consolidated with the Baltimore & Ohio Southwestern. In 1899, he returned to Washington as Master Mechanic of the Illinois & Indiana Division, from which position he is now promoted to that of Superintendent of Motive Power.

—Mr. Ira A. McCormack, whose promotion to the Managership of the "Harlem Line"—52nd street, New York, to Mott Haven—of the New York Central & Hudson River, is announced in another column, was for some time previous to coming to the New York Central, with the Cleveland (Ohio) Electric Railway as Manager. Mr. McCormack began his railroad service as a telegraph operator on the Pittsburg & Connellsville, and has served on the Pittsburg & Lake Erie, the Hudson River Division of the New York Central (as Trainmaster), and the Lake Shore & Michigan Southern. In 1895 he went to the Brooklyn Heights (Street) Railway; in 1899, he resigned there and went to Syracuse, and thence to Cleveland. From his Cleveland position he resigned in 1902, to come east as Assistant Manager of the Grand Central Station, and continued as such up to his present promotion.

—Mr. Charles F. Smith, Assistant General Superintendent of the New York Central & Hudson River, was born on June 17, 1873. He has been with this company since boyhood, beginning as a messenger boy. In 1887 he went to the Harlem Division at White Plains as clerk in the Superintendent's office. During 1889 and 1890 he was in General Superintendent Voorhees' office, and the following year became clerk for the Superintendent of the Hudson Division. For two years Mr. Smith was Secretary to General Manager Toucey, and in February, 1895, became chief clerk of the Western Division at Buffalo. From this position he came, in 1898, to New York City to take a similar place in the General Superintendent's office. In May, last year, he was appointed Superintendent of Passenger Transportation, from which position he is now promoted to that of Assistant General Superintendent. It is always encouraging to record in these columns the results of industry, loyalty and ability in the service of one corporation. In earlier days wandering from one service to another had, or was supposed to have, the result of adding to the man's store of information and a broadening of his mind, but nowadays everything is available by the man who stays. The value to the company of the officer so developed is great, and the encouragement to loyalty given by such promotions has a still greater value.

ELECTIONS AND APPOINTMENTS.

Baltimore & Ohio Southwestern.—F. J. Smith, hitherto Master Mechanic at Chillicothe, Ohio, has been appointed Master Mechanic, with headquarters at Washington, Ind., succeeding John Hair, promoted.

Boston & Maine.—See Rutland.

Canadian Pacific.—F. F. Busteed has been appointed Superintendent of the Pacific Division, with headquarters at Nelson, B. C., succeeding D. G. Ross, resigned. C. E. Cartwright has been appointed Acting Division Engineer, with headquarters at Vancouver, B. C., succeeding Mr. Busteed. N. E. Brooks has been appointed Division Engineer of the Western Division, with headquarters at Calgary, Alta., succeeding A. S. Dawson, resigned, effective Nov. 1.

Chicago & Alton.—Charles A. Goodnow until three weeks ago General Manager of the Chicago, Rock Island & Pacific, has been appointed General Manager of the C. & A., with headquarters at Chicago.

Cleveland, Cincinnati, Chicago & St. Louis.—W. P. Deppe, Chief Assistant General Passenger Agent, has been put in charge of the World's Fair business at St. Louis.

Delaware & Hudson.—A. J. Stone, hitherto Assistant to the General Manager of the Erie, has been appointed Assistant to the Second Vice-President of the D. & H., with headquarters at Albany, N. Y.

Erie.—See Delaware & Hudson.

Grand Central Depot (New York).—Ira A. McCormack, Manager, announces the appointment of Joseph H. Franklin as Assistant Manager.

Great Northern.—L. W. Hill has been elected Vice-President, succeeding his brother, J. N. Hill, resigned.

Michigan Central.—George H. Webb has been appointed Assistant Chief Engineer, with headquarters at Detroit, Mich., succeeding R. C. St. John, resigned. G. Sharp has been appointed Division Engineer, with headquarters at Jackson, Mich., succeeding Mr. Webb, and Mr. Sharp in turn is succeeded by W. L. Love as Division Engineer, with headquarters at Detroit, Mich.

Mobile, Jackson & Kansas City.—F. E. Dewey, hitherto General Superintendent of the St. Louis, Memphis & Southeastern, has been appointed General Manager of the M., J. & K. C., with headquarters at Mobile, Ala.

New York Central & Hudson River.—Charles F. Smith, hitherto Superintendent of Passenger Transportation, has been appointed Assistant General Superintendent, with headquarters at Grand Central Station, New York, effective Nov. 1. The position formerly held by Mr. Smith has been abolished. Ira A. McCormack has been appointed Manager of the Harlem Line, 52nd street to Mott Haven Junction, and of the Mott Haven Yard. (See Grand Central Depot.) O. G. Getzen-Danner has been appointed General Land and Tax Agent, with headquarters in New York City.

Pennsylvania.—J. K. Johnston, hitherto Principal Assistant Engineer of the Pennsylvania Railroad Division, has been appointed Superintendent of the Tyrone Division, with headquarters at Tyrone, Pa., succeeding S. S. Blair. L. R. Zollinger has been appointed to succeed Mr. Johnston at Altoona, Pa.

Pere Marquette.—H. O. Halsted has been appointed Superintendent of the Detroit District, with headquarters at Plymouth, Mich. This district includes the following territory: The Toledo Division and branches, the Detroit Division and branches, the Grand Rapids Division, and the Ionia Division, Grand Ledge to Ionia, including Ionia terminals. The terminals at Saginaw will be under the jurisdiction of the Superintendent of the Saginaw District, and the terminals at Grand Rapids will be under the jurisdiction of the Superintendent of the Grand Rapids District.

Quebec Southern.—C. B. Hibbard, hitherto General Passenger Agent of the Rutland, has been appointed General Manager of the Q. S.

Rutland.—C. A. Nimmo, hitherto General Western Passenger Agent of the Boston & Maine, has been appointed General Passenger Agent of the Rutland, with headquarters at Rutland, Vt., succeeding C. B. Hibbard, resigned. (See Quebec Southern.)

St. Louis & San Francisco.—R. R. Hammond, hitherto General Manager of the Chicago & Eastern Illinois, has been appointed General Manager of the "Frisco" System.

St. Louis, Memphis & Southeastern.—See Mobile, Jackson & Kansas City.

Southern.—O. D. Kiilebrew has been appointed Assistant Superintendent, with headquarters at Columbia, S. C. W. A. Fort has been appointed Resident Engineer, with headquarters at Columbia, S. C., succeeding Mr. Kiilebrew.

Texas & New Orleans.—E. J. Nichols has been appointed Resident Engineer, with headquarters at Houston, Texas, succeeding L. Beauman.

Western Maryland.—J. A. Shepherd has been appointed Superintendent of Transportation of this company and the West Virginia Central & Pittsburg, with headquarters at Hillen Station, Baltimore, Md. The office of Car Accountant of the W. V. C. & P. has been abolished.

West Virginia Central & Pittsburg.—See Western Maryland.

LOCOMOTIVE BUILDING.

The Shreveport & Red River Valley is having four locomotives built at the Baldwin Works.

The Seaboard Air Line denies that it has recently ordered 30 locomotives from the Baldwin Works.

The Buffalo, Rochester & Pittsburg is having five locomotives built at the Brooks Works of the American Locomotive Company.

The Delaware & Hudson is having four locomotives built at the Dickson Works of the American Locomotive Company at Scranton, Pa.

The Baltimore & Ohio has increased its equipment during the past year by the purchase of 200 locomotives. Of these, 150 were freight locomotives weighing 193,000 lbs., 20 were Atlantic (4-4-2) locomotives weighing 177,000 lbs., and 30 were six-wheel switching (0-6-0) engines. The company has also purchased two 160-ton electric motors and three 96-ton motors.

CAR BUILDING.

The Northern Pacific, it is reported, will build 1,500 flat cars at its shops.

The Pennsylvania Lines West will order 58 new cars during the coming year.

The Pabst Brewing Co., Milwaukee, is in the market for 300 refrigerator cars.

The Consolidated Railroads of Yucatan are reported to be in the market for new rolling stock.

The West Virginia & Southern has ordered 30 tank cars from the American Car & Foundry Company.

The Enterprise Lumber Company is having 32 flat cars of 50,000 lbs. capacity built at the Georgia Car & Mfg. Co.

The Buffalo & Lake Erie is having two coaches built at the Wilmington works of the American Car & Foundry Company.

The Kellcys Creek & Northwestern is reported to be about to purchase or lease 500 standard gage coal cars. The headquarters of the company are at Cedar Grove, W. Va.

The Cumberland Valley, as reported in our issue of Oct. 16, is having five vestibule coaches and four baggage and express cars built at its Chambersburg shops. The coaches will be 67 ft. 2¾ in. long, 10 ft. ¾ in. wide and 14 ft. 9 in. high. The baggage express cars will be 50 ft. long, 9 ft. 8 in. wide and 15 ft. high. Special equipment includes Westinghouse brakes, Diamond special brake-beams, American Brake-Shoe & Foundry Co.'s brake-shoes and Edwards curtain fixtures.

The Canada Atlantic, as reported in our issue of Oct. 30, expects to build shortly at its shops 25 flat cars of 80,000 lbs. capacity. The cars will weigh 30,300 lbs., and measure 40 ft. long, 9 ft. 6 in. wide and 4 ft. 2 in. high, to be built of wood, with wooden underframes. The special equipment will include: Simplex bolsters and brake-beams, Canada Atlantic brake-shoes, Magnus Metal Co.'s brasses, Worthington couplers, Miner draft rigging, and Symington dust guards, journal boxes and lids.

The Atlantic Coast Line, as reported in our issue of Oct. 16, is building 550 flat cars of 60,000 lbs. capacity at its Wilmington, N. C., shops, for January, 1904, delivery. These cars will weigh 27,000 lbs. and will be 40 ft. long and 9 ft. wide over end sills, and 4 ft. 4¼ in. high from rail to floor. Special equipment includes Westinghouse brakes, Tower couplers, Thornburg draft rigging, Sterlingworth brake-beams, Ryan dust guards, P. S. Reeves & Son brasses. National malleable journal boxes and journal box lids, American Steel Foundries' bolsters and Tredegar 33-in. cast iron wheels.

The Coahuila & Zacatecas has ordered 10 box and 10 coke cars of 55,000 lbs. maximum capacity from the American Car & Foundry Co. The box cars will weigh 24,400 lbs., and measure 29 ft. 5⅝ in. long, 7 ft. 5⅝ in. wide and 6 ft. 2¼ in. high, all inside measurements. The coke cars will weigh 18,300 lbs., and measure 27 ft. 6¾ in. long, 6 ft. 10¼ in. wide, inside the rack, and 8 ft. high, from sill to top of rack. The cars will be built of wood, with wooden underframes. The special equipment for both includes: American Steel Foundries' bolsters and trucks, Sterlingworth brake-beams, Westinghouse air-brakes, Tower couplers, National Malleable Castings Co.'s door fastenings and Wagner doors for the box cars, American continuous draft rigging, Winslow roofs for the box cars, and American Car & Foundry Co.'s wheels.

BRIDGE BUILDING.

AKRON, OHIO.—The City Council is considering the building of a viaduct for which plans are prepared, at Mill street. The structure will include a steel span 165 ft. long, with concrete walls and filled approaches. The probable cost is about $90,000.

BELVIDERE, N. J.—Bids may soon be asked for a new bridge to replace one recently destroyed by floods, the probable cost of which will be $25,000.

BETHLEHEM, PA.—It is reported that a steel bridge 2,000 ft. long and 70-ft. wide will be built over the Lehigh River and Monocacy Creek, at a cost of about $250,000. Address C. M. Dobson.

BIG SANDY, TENN.—Bids are being asked until Nov. 9, by Henry and Benton Counties, for the building of a bridge over the Big Sandy. S. T. Doty, Henry County, Commissioner.

BOXVILLE, MINN.—Bids are wanted by the Board of Supervisors of the town of Boxville, Marshall County, Nov. 14, for the building of an iron bridge over Snake River, of one span 40 ft. long, with 16-ft. roadway on cylinder piers, at Boxville, Marshall County, the work to be completed by Dec. 31. John Cheney, Supervisor.

CHINO, CAL.—Plans are being prepared for an 80-ft. single span steel bridge over Chino Creek, to be built by the county.

DES MOINES, IOWA.—Bids are wanted by the Board of Public Works, Nov. 6, for the East Sixth street bridge, the former bids having been rejected. J. W. Budd, City Engineer. (Oct. 16, p. 749.)

EAST TORONTO, ONT.—A new bridge, it is reported, may be built at the west end of the village.

FAIRBURY, NEB.—Bids are wanted up to Dec. 2, by W. S. Diller, County Clerk, for the building and repairing of the wooden and iron bridges in Jefferson County, for the term of one year commencing Jan. 1, 1904.

FORT SNELLING, MINN.—The C., St. P., M. & O. Ry. and the street railway company may jointly build a bridge over the Mississippi.

FREDERICTON, N. B.—The New Brunswick Government is asking bids up to Nov. 16, for the steel superstructure of French Fort Cove bridge.

Bids are wanted Nov. 9 by the New Brunswick Government for rebuilding the Woods Mill bridge in the Parish of Petersville.

KNOXVILLE, TENN.—Bids are being received by John Maxey, chairman of the road commissioners, for the building of seven bridges and trestles in the county.

LAWRENCE, KAN.—Bids are wanted Nov. 14, by the County Clerk, for a bridge consisting of two 40-ft., two 65-ft., one 125-ft. and five 150-ft. steel Pratt trusses, on 5-ft. cylinders, to be built over the Kansas River at Endora. Douglas and Leavenworth Counties will each issue $10,000 in bonds and use the proceeds to pay for this work.

LITTLE ROCK, ARK.—Marion County will build a steel bridge over Cripple Creek in Yellowville.

LOS ANGELES, CAL.—Plans are ready for the new Fourth street bridge to be built over the railroad tracks and Los Angeles river. There are to be five combination wood and steel spans supported on steel trestle towers over the railroad tracks, and three deck spans of 100 ft. each over the river resting on concrete and steel cylinders. The entire bridge with approaches will be about 2,000 ft. long. Bids will soon be opened.

MEMPHIS, TENN.—The city officials and the railroad companies have reached an agreement for the building of steel bridges at McLenore avenue, between Rayburn and Florida, over the tracks of the railroad company.

The city will build a steel bridge 100 ft. long and 30 ft. wide at Elmwood cemetery. J. A. Omberg, City Engineer.

NILES, OHIO.—An agreement has been reached by the city officials and the Mahoning Valley, and bids will soon be asked for the bridge at Robbins avenue, the building of which will begin early next spring.

POPLAR BLUFF, MO.—Bids are wanted Nov. 7 for the building of a bridge over Jones' Slough. B. J. Puckett, Commissioner.

PORTLAND, ORE.—Bids are wanted by Thomas C. Devlin, Auditor, Nov. 25, for the rebuilding of the bridge over the Willamette River.

PORT LAVACA, TEXAS.—The plans of the Rice Belt include the rebuilding of a bridge 2¼ miles long over the Lavaca Bay from Cox's to Noble's Point.

QUEBEC, QUE.—The Dominion Government has agreed to guarantee the bonds on the Quebec bridge to the extent of $6,678,200 at 3 per cent. The Government will

control the tolls on the bridge, and reserves the right to buy it at any time. The bridge receives a subsidy of $1,000,000, of which $374,353 has been paid by the Government to the company: the balance will be held by the Government to meet the interest on the bonds.

RAMAPO, N. Y.—A vote will be taken on the question of appropriating $25,000 for building bridges.

ROCK ISLAND, ILL.—Bids are wanted Nov. 9, by Wallace Treachler, City Engineer, for building two spans, 1,400 ft. long, of a steel highway bridge.

ST. PAUL, MINN.—The city is taking steps to compel the Great Northern and the Minneapolis & St. Louis roads to rebuild the bridges over their tracks at Western avenue and Holden street.

SCHENECTADY, N. Y.—The city authorities have approved the plans of the New York Central for the building of three bridges over its tracks at Congress street, Crane street and Brandywine avenue.

SPRINGFIELD, OHIO.—The town commissioners, local reports state, will build a new bridge near New Carlisle.

TAUNTON, MASS.—Bids have been asked by the County Commissioners for a note for $20,000, the proceeds of which are to be used to build a bridge over Taunton Great River between Fall River and Somerset.

Other Structures.

ANDERSON, IND.—The Central of Indiana has plans prepared for the building of a passenger station and general office building early next spring. It is to be of brick and stone and will cost about $25,000.

BRANDON, MAN.—The Canadian Pacific, it is reported, will build a freight shed 40 ft. x 400 ft. at Brandon.

CHICAGO, ILL.—The Francis & Nygren Foundry Company, of Chicago, has plans ready for a one-story foundry building of brick and steel, 100 ft. x 140 ft., to cost about $30,000. The building will contain a carpenter shop, foundry, office and pattern shop.

A permit has been issued by the Building Department to the Chicago & Western Indiana for a brick passenger station of two stories in 23rd street.

DILLON, MONT.—The Oregon Short Line, local reports state, is planning to build a brick roundhouse at Dillon.

GRAND RAPIDS, MICH.—Press reports state that the Pere Marquette is preparing plans for an engine house, to cost about $40,000.

MONTREAL, QUE.—The Canadian Pacific directors, it is stated, have voted $35,000 to build a new passenger station at Mile End.

TAMPICO, MEXICO.—The Mexican Central has plans ready for a new passenger station, to be built of brick.

VELASCO, TEXAS.—The Velasco, Brazos & Northern has bought about 45 acres of land at this port as a site for its wharf and terminal facilities.

WILMINGTON, N. C.—The Seaboard Air Line, reports say, will build a new warehouse on Nut street, 100 ft. x 300 ft., at a cost of about $20,000.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ARLINGTON & PACIFIC COAST.—The newspapers say that rights of way for this proposed line from Arlington, Ore., south to Fossil, 60 miles, have been secured, and that surveys will shortly be begun. J. P. Finley and J. E. Simmons, Portland, Ore., are interested. (See Construction Supplement.)

ATCHISON, TOPEKA & SANTA FE.—It is reported that the branch line from Newkirk to Tecumseh, Okla. T., 130 miles, will be opened for traffic about Dec. 1.

CHICAGO GREAT WESTERN.—An officer denies that this company is about to build a cut-off from Reinbeck, Iowa, east to Dubuque.

COEUR D'ALENE & SPOKANE (ELECTRIC).—Track laying has been completed on this railroad from Spokane, Wash., to Coeur d'Alene, Idaho, 33 miles, and the road will be put in operation about Nov. 15. J. C. White, Coeur d'Alene, is Chief Engineer. (May 29, p. 384.)

DELAWARE, LACKAWANNA & WESTERN.—The work of elevating the tracks of this company through Newark, N. J., is practically completed. The section from the Passaic River to a point west of High street, Newark, is finished, and will shortly be opened for traffic. The elevation of the tracks in Harrison, east of Newark, is so far completed that a portion of the line will be used for westbound passenger trains within a few days.

DES MOINES, IOWA FALLS & NORTHERN.—At a special meeting of the directors of this company on Oct. 28, the road was formally taken over from the Globe Construction Company which built it. The line is from Des Moines to Iowa Falls, 76 miles. F. E. Ellsworth, Iowa Falls, is President. (Oct. 2, p. 714.)

GULF, COLORADO & SANTA FE.—Press reports state that a contract has been awarded to Burns & Co., Saratoga, Texas, for building an extension from Votaw, on the main line, south to the Saratoga oil fields, 15 miles.

INDIANAPOLIS SOUTHERN.—The Kenefick Construction Company of Pittsburg, which is building this road between Indianapolis and Bloomington, has sub-let a part of its contract to McCann Bros. (Oct. 2, p. 714.)

INDIAN TERRITORY ROADS.—Press reports state that the Central Coal & Coke Co., of Kansas City, Mo., is planning to build a railroad from Sapulpa, Ind. T., on the main line of the St. Louis & San Francisco, east to Coal Creek, five miles.

KELLEYS CREEK & NORTHWESTERN.—It is reported that this company, which is building a line from Cedar Grove, W. Va., northwesterly to Sutton, has completed the first five miles. Location surveys for the remainder of the route are now in progress. F. M. Staunton, Charleston, W. Va., is interested. (May 22, p. 368.)

LAWTON, WICHITA MOUNTAIN & WESTERN (ELECTRIC).—This company has been incorporated in Oklahoma Territory to build from Lawton north to Fort Sill, five miles, and eventually to Lone Wolf. The proposed road will parallel the Chicago, Rock Island & Pacific between the first two named points. R. A. Hubbard, J. H. Russell, and others of Lawton, Okla. T., are incorporators.

MCMINNVILLE, WOODBURY & NASHVILLE (ELECTRIC).—Press reports state that the contract for building this electric road between the above named points, a distance of 60 miles, has been let to the Ellis Construction Company of Chicago. T. S. Weaver, W. S. Henderson and others of Nashville, Tenn., are said to be interested. (Aug. 14, p. 594.)

MANISTEE & REPTON.—Work is reported in progress on the extension of this road from a point on the main line north to Monroeville, Ala. The present line is from Manistee to Manistee Junction, 19 miles. It is stated that the extension will be finished by the first of the year. W. H. Louisell, Manistee, Ala., is President.

MEXICAN CENTRAL.—Press reports state that the extension from San Pedro to Paredon, 140 miles, has been completed, with the exception of a few bridges. Work on this extension was started in May, 1902, and 40 miles of track were laid during that year. The extension will give the Mexican Central a direct line from Torreon to the Port of Tampico and the city of Monterey.

MEXICAN ROADS.—A concession has been granted by the Mexican Government, to the San Carlos Copper Company for building and operating a standard gage railroad from Linares, southeast through the San Jose mining district to Soto de la Marina, in the State of Nuevo Leon, 100 miles. Under the terms of the concession, surveys must be begun within one year, and the entire line must be finished within seven years.

The Oaxaca & Ejutla has been granted a concession by the Mexican Government to build a branch from a point on its main line west to the town of Zimatlan, five miles. The road runs at present from Oaxaca to Ocotlan, 24 miles.

A concession has been granted to Luis Garcia Teruel to build a railroad from San Marcos, in the State of Tlaxcala, southeast to Sosendo Marquez, a point on the Mexican Southern.

A concession has been granted by the Mexican Government for building a railroad from the Tiro General mines, in the State of San Luis Potosi, to Los Charcos, where connection will be made with the National of Mexico. T. J. Ryder, Los Charcos, is said to be interested.

NEW IBERIA & NORTHERN.—This company has been organized in Louisiana to build a railroad from a point near New Iberia, in a northwesterly direction to Natchitoches, 150 miles. The names of incorporators are not stated.

NEW MEXICAN ROADS.—Press reports state that the Phelps-Dodge Company will soon begin work on a railroad from Deming, N. Mex., north through the Membres Valley to coal fields owned by the company in McKinley County, N. Mex.

NEW YORK CENTRAL & HUDSON RIVER.—Bids will be received until 3 p.m. Nov. 11, for the construction up to sub-grade of a single track change of line about 1½ miles long, on the Mahopac branch of the New York & Harlem near Goldenbridge, N. Y.

NORTHERN PACIFIC.—Press reports state that the branch line from Mackenzie, N. Dak., to Linton, 45 miles, has been completed and that the line will be opened for traffic at once.

OCILLA, PINE BLOOM & VALDOSTA.—Press reports state that an extension of this line from Garretts, Ga., west to Nashville, six miles, is practically completed. Connection will be made with the Nashville & Sparks at Nashville. E. B. Gray, Nashville, Ga., is President. (May 1, p. 320.)

O'CONNELL R. R.—This company has been incorporated in Pennsylvania, to build a steam railroad four miles long from a point on the north side of the Lancaster turnpike to the east borough line at Coatesville. T. E. O'Connell, Westchester, Pa., is President.

PENSACOLA, ALABAMA & WESTERN.—A charter has been asked by this company, with power to build from Pensacola, Fla., north to the Alabama State line, 45 miles. H. L. Covington is President, and W. J. Forbes, Secretary, both of Pensacola.

PERE MARQUETTE.—Surveys are reported completed for a branch from Leota, Mich., to Stratford, 30 miles. The work will include several bridges over the Muskegon River. F. H. Alfred, Detroit, is Chief Engineer.

PHOENIX & EASTERN (SANTA FE, PRESCOTT & PHOENIX).—An officer writes that grading has been completed for a distance of 65 miles beyond Phoenix, Ariz., and that the remainder of the line to Benson is now under contract. Track has been laid for a distance of 23 miles. The Bradshaw Mountain branch has been finished to a point 22 miles west of Mayer, and the remaining five miles to Crown King are now under contract.

PONCE & GUAYAMA.—This company has been incorporated in New Jersey to build a steam railroad from Ponce, in the Island of Porto Rico, east to Guayama, 50 miles. L. A. Ford, Henry Endicott, Jr., and J. C. Rice, all of 70 State street, Boston, Mass., are incorporators.

ST. LOUIS & SAN FRANCISCO.—It is officially announced that the line from Guthrie to Chandler, Okla. T., 38 miles, which was recently completed by the Choctaw, Oklahoma & Gulf, will be operated by the St. Louis & San Francisco as the Guthrie branch of the Southwestern Division.

ST. LOUIS, EL RENO & SOUTHWESTERN.—Grading is reported completed between Guthrie and El Reno, and 12 miles of track have been laid. It is stated that train service will be established between these two points about Dec. 15.

ST. LOUIS, KANSAS CITY & COLORADO.—This company has completed its extension from the Gasconade River west to Eldon, Mo., 40 miles. Work is now in progress on an extension from Eldon to Versailles. (See Construction Supplement.)

SANDY VALLEY & ELKHORN.—A charter has been granted this company in Kentucky, to build a railroad from Praise southwest through the Elkhorn coal region to Whitesburg, 30 miles. It is stated that contracts for grading will shortly be let. The headquarters of the company are at Praise, Ky.

SILVERTON & NORTHERN.—An officer writes that grading is in progress on the extension from Eureka, Colo., to Ammas Forks, four miles. The line will be opened for traffic about June 1, 1904. Alexander Anderson, Silverton, Colo., is General Manager. (Oct. 16, p. 750.)

SOUTHERN.—It is reported that the second track work from Washington to Manassas, Va., will be finished by Jan. 1. Grading for second track is now in progress from Manassas southwest to Orange, Va., 52 miles. (Oct. 2, p. 714.)

SOUTHERN PACIFIC.—Press reports state that the narrow gage line from Alma, Cal., south to Santa Cruz, 20 miles, is to be made standard gage. The work will involve the widening of eight tunnels.

TOLEDO, BAY SHORE & MICHIGAN.—This company has been incorporated in Ohio to build an electric railroad from the terminus of the Toledo Railway & Light Company's line, to a point in Lucas County. W. F. Brown and others, of Toledo, Ohio, are interested.

UNION PACIFIC.—The 29 miles of double track between Borie, Wyo., and Buford have been finished, and are now in operation. The completion of this line gives the Union Pacific a double track from Cheyenne to Laramie, except for a short distance between Buford and Hermosa Junction. Ten miles of double track from Cheyenne east to Archer have also been completed, and will shortly be placed in operation.

WASHINGTON ROADS.—Articles of incorporation have been filed by the Sunnyside Construction Company, which proposes to build a railroad from Toppenish, on the Northern Pacific, southeast via Sunnyside to Prosser, 30 miles. Wm. Granger, G. P. Eaton, C. W. Chamberlain, C. E. Woods, E. F. Benson, and others, of Sunnyside, are incorporators.

WHITE RIVER VALLEY.—Incorporation has been granted this company in Colorado. It is reported that this company will build the connecting link between the Denver & Rio Grande and the Denver, Northwestern & Pacific. D. W. Aldrich, Galesburg, Ill., is President, and E. G. Kindred, Denver, Colo., is Treasurer.

WICHITA FALLS & OKLAHOMA.—This company has filed its charter with the Secretary of the State of Texas. It proposes to build a railroad from Wichita Falls, Texas, northeast to points in Oklahoma Territory. E. W. Taylor, H. C. Edrington, Fort Worth, Texas; Frank Kell, Wichita Falls, and others, are incorporators. A company called the Wichita, Arkansas Valley & Denver was reported as incorporated in our issue of Oct. 16. These two companies are to build in practically the same territory.

WISCONSIN CENTRAL.—This company has filed an amendment providing for two extensions—one from Park Falls, Price County, Wis., northeast to a point in Ashland County, 10 miles; and the other from Glidden, Ashland County, in a southwesterly direction for a distance of eight miles.

GENERAL RAILROAD NEWS.

BANGOR & AROOSTOOK.—The report of this company for the fiscal year ending June 30 shows gross earnings of $1,800,168, against $1,708,937 the previous year, an increase of $91,231. Operating expenses increased $28,625, leaving an increase in net earnings of $62,956.

CHICAGO & ALTON.—The report of this company for the fiscal year ending June 30 shows an increase in gross earnings of $845,352; an increase of $601,276 in operating expenses, and in net earnings of $244,076. President Felton says that the loss in revenue caused by the freshets at Kansas City and East St. Louis last spring amounted to $100,000. Operating expenses were largely increased during the year by the excessive cost of material, and by heavy expenditures in the maintenance departments.

CHICAGO, CINCINNATI & LOUISVILLE.—It is reported that this company has completed arrangements with the Chicago Terminal Transfer R. R. whereby the Cincinnati road will have the right to use the Grand Central Station at Chicago, and the freight terminal facilities of the terminal company. This road was formerly the Cincinnati, Richmond & Muncie.

CHICAGO, ROCK ISLAND & GULF.—Bids have been filed with the Secretary of the State of Texas, conveying to the above company for the considerations named below, the properties of all the subsidiary companies of the Rock Island System in Texas: Choctaw, Oklahoma & Texas, consideration $1,200,000; Chicago, Rock Island & Mexico, $1,000,000; Chicago, Rock Island & Texas, $3,500,000. The transfer of these lines to the Chicago, Rock Island & Gulf is in compliance with the requirements of the last session of the Texas Legislature.

LONG ISLAND.—It has been announced that this company has made a new refunding mortgage of $45,000,000, secured by 4 per cent. gold bonds, dated 1903 and due 1949. Of this issue, $25,000,000 will be reserved to retire all underlying bonds, and $10,000,000 will be retained for future requirements. The remaining $10,000,000 of new bonds, guaranteed principal and interest by the Pennsylvania R. R., have been sold to Kuhn, Loeb & Co. The proceeds from the sale of these bonds will be used for various improvements in connection with the Pennsylvania tunnels in New York City, and for additional terminal facilities at Bay Ridge and Long Island City.

PENNSYLVANIA.—Kuhn, Loeb & Co. have purchased $20,000,000 bonds of subsidiary companies. Of this amount, $10,000,000 are refunding mortgage 4 per cent. bonds of the Long Island R. R., guaranteed, principal and interest, by the Pennsylvania, and the remainder are first mortgage 4 per cent. gold bonds of the Philadelphia, Baltimore & Washington. Kuhn, Loeb & Co. have the option to pay for the bonds at any time before March 1, 1904.

PHILADELPHIA, BALTIMORE & WASHINGTON.—This company has made a mortgage for $20,000,000. Half of this issue has been sold to Kuhn, Loeb & Co., and the proceeds from the same will be used on the improvements at Washington, D. C. The new bonds will be 40-year 4 per cent. gold bonds. (See Pennsylvania R. R. above.)

SOUTHERN INDIANA.—The report of this company for the fiscal year ending June 30, shows gross earnings of $942,572, an increase of $312,377. Operating expenses were $460,546, an increase of $108,203, leaving an increase in net earnings of $204,174. The percentage of operating expenses to gross earnings decreased from 55.91 to 48.87. After payment of interest, rentals, taxes and the regular dividend on preferred stock, the surplus was $516,820, which is equal to 8 per cent. on the common stock.

VERA CRUZ & PACIFIC.—The Maryland Trust Company of Baltimore, which failed last week, owns all the securities of this road. The *Commercial and Financial Chronicle* says that "the road cost about $10,000,000, which was a good deal more than had been expected. The trust company's investment is said to be about $6,000,000. The distance from ocean to ocean by the Vera Cruz & Pacific, is 207 miles, and the plan is to use the line as part of a through route from near Atlantic ports to San Francisco, and other Pacific ports. From New York to San Francisco the distance by this route would be 2,189 miles, as against 3,277 miles via Panama, a saving of 1,088 miles. An equal saving would also be made from New York to Manila, Yokohama and Hong Kong."